EXHIBIT 1

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE REEXAMINATION OF U.S. PATENT NO. 9,297,150

INVENTOR: MICHAEL EDWARD KLICPERA

FILED: FEBRUARY 26, 2013

FOR: WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM

SUPPLEMENTAL CLAIM CHARTS

U.S. REEXAMINATION NO. 90/014,354

MAIL STOP INTER PARTES REEXAMINATION
ATTN: CENTRAL REEXAMINATION UNIT
COMMISSIONER FOR PATENT
P.O. Box 1450
ALEXANDRIA, VA 22313-1450

Re: 90/014,354

Dear Sir/Madam:

Rein Tech is proposing to add claims 21, 23 and 26 to the original claim charts for claims 8-20 and 28 that were submitted on August 2, 2019. Claims 21, 23 and 26 have been defined as "**Newly Added Claims**" (highlighted in bold) within the claim charts and no changes have been made in the original claims previously submitted. These updated claims charts are defined as supplemental claim charts and will be submitted into the 90/014,354 Reexamination File History using the Electronic Filing System.

Any questions or comments may be directed to the undersigned at (619) 980-8680 or by email at debonair7@att.net.

Sincerely,

/Michael Klicpera/

Michael Klicpera
Registered Patent Attorney #38044

<u>CC1</u>

US. Patent 9,297,150 Claim Chart - Sears 5,719,564

'150 Claim 8 CC1	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A method for communicating utility usage-related information from a plurality of meter modules to a plurality of data accumulator units, each of which periodically transmits data to a control computer, including the steps of periodically transmitting from each meter module a first signal indicative of utility usage-related information and wherein the first signal includes a flag for self-configuring the communications network when the meter module is initially installed. The signal strength of the first signals from a meter module received at a data accumulator unit are measured and ranked by the control computer based on received signal strength. The ranking based on signal strength is utilized to enable only a limited number of data accumulators (those which received the strongest first signals) to receive, record and store data from a particular meter module.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Fig. 1, 4, Col. 4, lines 15-20 While a cell phone 22 has been illustrated to communicate between the data accumulator units 18 and the control computer 24, other data links, such as RF, phone lines, cable, or photo-optic transmissions means can be utilized in a well-known manner to connect the data accumulator units 18 to the control computer 24. Col 9, lines 51-59 In the preferred embodiment the data accumulator units 18 are adapted to communicate with the computer on a periodic basis and the control computer 24 can not communicate with each data accumulator unit 18 unless the cell phone of the data accumulator unit 18 has established a communications link with the control computer 24. This mode of operation consumes much less energy than if the data accumulation unit 18 was constantly "on" looking for a message from the control computer 24. The utilization of a data accumulator unit 18 which periodically transmits its data and then denergizes

	its data transfer circuitry until the next periodic transmission allows the unit 18 to be powered by a battery and a solar cell. However, in some cases it may be desirable to establish a two-way communication link with the data acumulator units 18 and this can be acomplished by providing a transmitting-receiving cell phone or an RF link with the control computer.
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	
said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC1	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC1	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	

'150 Claim 11 CC1	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC1	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC1	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	
'150 Claim 14 CC1	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC1	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 4, lines 15-20 While a cell phone 22 has been illustrated to communicate between the data accumulator units 18 and the control computer 24, other data links, such as RF, phone lines, cable, or photo-optic transmissions means can be utilized in a well-known manner to connect the data accumulator units 18 to the control computer 24. Col 9, lines 51-59 In the preferred embodiment the data accumulator units 18 are adapted to communicate with the computer on a periodic basis and the control computer 24 can not communicate with each data accumulator unit 18 unless the cell phone of the data accumulator unit 18 has established a communications link with the control computer 24. This mode of operation consumes much less energy than if the data accumulation unit 18 was constantly "on" looking for a message from the control computer 24. The utilization of a data accumulator unit 18 which periodically transmits its data and then denergizes its data transfer circuitry until the next periodic transmission allows the unit 18 to be powered by a battery and a solar cell. However, in some cases it may be desirable to establish a

	two-way communication link with the data acumulator units 18 and this can be acomplished by providing a transmitting-receiving cell phone or an RF link with the control computer.
'150 Claim 16 CC1	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC1	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC1	
18. A building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	
'150 Claim 19 CC1	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC1	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	

'150 Claim 21 CC1 - **(Newly Added Claim)**	
A building or structure water damage prevention system, said system comprising:	
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply to a residential home or industrial/commercial facility or building;	Abstract - A method for communicating utility usage-related information from a plurality of meter modules to a plurality of data accumulator units, each of which periodically transmits data to a control computer, including the steps of periodically transmitting from each meter module a first signal indicative of utility usage-related information and wherein the first signal includes a flag for self-configuring the communications network when the meter module is initially installed. The signal strength of the first signals from a meter module received at a data accumulator unit are measured and ranked by the control computer based on received signal strength. The ranking based on signal strength is utilized to enable only a limited number of data accumulators (those which received the strongest first signals) to receive, record and store data from a particular meter module.
said remotely controllable base station with a said water shutt-off/on mechanism adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	
an alarm or computer system;	
said remotely controllable base station include a recording compliance data means;	
said alarm or computer system includes electronic circuitry to send a wireless signal to said remotely controllable base statio to turn said water supply on and off, said wireless signal utilizing encrytion, authentic, integrity and/or non-repudiate technology, and	
said alarm or computer system having the capability to receive a wireless electronic communication whereby said alarm or computer includes an indicating means for determining an operational state or position of the shut-off/on mechansim.	
'150 Claim 23 CC1 - **(Newly Added Claim)**	
23. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.	

'150 Claim 26 CC1 - **(Newly Added Claim)**	
26. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station requires an intial pairing technology to provide a specific wireless communication means between with said alarm or computer system and said remotely controllable base station.	
'150 Claim 28 CC1	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

<u>CC2</u>

US. Patent 9,297,150 Claim Chart – Meek 6,181,257

'150 Claim 8 CC2	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A universal utility usage data gathering system that is capable of operating with any other read pad data gathering system, regardless of protocol. The universal system comprises of two components. One--a transponder which is the actual device that accumulates utility usage and will transfer accumulated usage to a reader/interrogator system. Two--the universal reader/interrogator, which will universally read any transponder for which the reader is programmed to accept from the transponder read pad. The universal reader/interrogator is based on standard micro-electronic chips and utilizes a multi-tapped antenna making the device capable of communicating with any transponder. The universal reader/interrogator will determine what protocol from any transponder.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 14, lines 30-36 The transponder communicates with its reader using electromagnetic waves launched from a coil or winding within the transponder, unless the meter is part of an Automatic Meter Reading (AMR) system. (AMR systems utilize hard wired transmission lines, telephone lines, cell-phone transmissions, PCS transmissions, or similar dedicated data transmission lines.)
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC2	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC2	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC2	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC2	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC2	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC2	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC2	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 14, lines 30-36 The transponder communicates with its reader using electromagnetic waves launched from a coil or winding within the transponder, unless the meter is part of an Automatic Meter Reading (AMR) system. (AMR systems utilize hard wired transmission lines, telephone lines, cell-phone transmissions, PCS transmissions, or similar dedicated data transmission lines.)
'150 Claim 16 CC2	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC2	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC2	
18. A building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	
'150 Claim 19 CC2	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	

'150 Claim 20 CC2	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 21 CC2 - **(Newly Added Claim)**	
A building or structure water damage prevention system, said system comprising:	
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply to a residential home or industrial/commercial facility or building;	Abstract - A universal utility usage data gathering system that is capable of operating with any other read pad data gathering system, regardless of protocol. The universal system comprises of two components. One--a transponder which is the actual device that accumulates utility usage and will transfer accumulated usage to a reader/interrogator system. Two--the universal reader/interrogator, which will universally read any transponder for which the reader is programmed to accept from the transponder read pad. The universal reader/interrogator is based on standard micro-electronic chips and utilizes a multi-tapped antenna making the device capable of communicating with any transponder. The universal reader/interrogator will determine what protocol from any transponder.
said remotely controllable base station with a said water shutt-off/on mechanism adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	
an alarm or computer system;	
said remotely controllable base station include a recording compliance data means;	
said alarm or computer system includes electronic circuitry to send a wireless signal to said remotely controllable base statio to turn said water supply on and off, said wireless signal utilizing encrytion, authentic, integrity and/or non-repudiate technology, and	
said alarm or computer system having the capability to receive a wireless electronic communication whereby said alarm or computer includes an indicating means for determining an operational state or position of the shut-off/on mechansim.	

'150 Claim 23 CC2 - **(Newly Added Claim)**	
23. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.	
'150 Claim 26 CC2 - **(Newly Added Claim)**	
26. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station requires an intial pairing technology to provide a specific wireless communication means between with said alarm or computer system and said remotely controllable base station.	
'150 Claim 28 CC2	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

<u>CC3</u>

US. Patent 9,297,150 Claim Chart - Bowman 7,310,052

'150 Claim 8 CC3	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A wireless meter-reading system includes a utility meter having a housing and a face and a recording device located in the housing. The recording device is adapted to read and convert data located on a portion of the face to wirelessly transmittable data. A power source coupled to the recording device permits continuous and instantaneous capture of the wirelessly transmittable data from the face of the utility meter by the recording device. A communication device provided for wirelessly receiving and transmitting data between a consumer site and a utility provider site facilitates monitoring of the face of the utility meter by the consumer site and by the utility provider site. A method for allowing a consumer to join a secured wireless network of a utility provider comprises the consumer paying a fee to the utility provider. Both the consumer and the utility provider benefit from this arrangement.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	Fig. 4, Col. 6. lines 53-55 It is understood that without limitation the utility meter 12 may comprise at least one of an electric meter, a gas meter, a water meter, and the like.
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 6, lines 3-19 Alternatively, the communication device 30 may be at least one of a satellite (depicted as a portion of a block diagram denoted "receiver and transmitter") and a cell phone network (depicted as a portion of a block diagram denoted "receiver and transmitter"), and the like. The communication device 30 is wirelessly coupled to the recording device 12 (such as a wireless cell phone). It is understood that when the communication device 30 is coupled to a wireless cell phone, the wireless cell phone further comprises at least a recording device 12 such as a digital camera, and the like. The wireless cell phone may be programmed to respond to transmissions from both the customer site 36 and the utility company site 38. Each one of the satellite and the cell phone network is adapted to relay data from the recording device 12 located in the housing 22 of the utility meter 14 to the consumer site 36 and to the utility provider site 38.

said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	
said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC3	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC3	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC3	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	

'150 Claim 12 CC3	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC3	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	
'150 Claim 14 CC3	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC3	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 6, lines 3-19 Alternatively, the communication device 30 may be at least one of a satellite (depicted as a portion of a block diagram denoted "receiver and transmitter") and a cell phone network (depicted as a portion of a block diagram denoted "receiver and transmitter"), and the like. The communication device 30 is wirelessly coupled to the recording device 12 (such as a wireless cell phone). It is understood that when the communication device 30 is coupled to a wireless cell phone, the wireless cell phone further comprises at least a recording device 12 such as a digital camera, and the like. The wireless cell phone may be programmed to respond to transmissions from both the customer site 36 and the utility company site 38. Each one of the satellite and the cell phone network is adapted to relay data from the recording device 12 located in the housing 22 of the utility meter 14 to the consumer site 36 and to the utility provider site 38.
'150 Claim 16 CC3	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	

'150 Claim 17 CC3	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC3	
18. A building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	
'150 Claim 19 CC3	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC3	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	

'150 Claim 21 CC3 - **(Newly Added Claim)**	
A building or structure water damage prevention system, said system comprising:	Abstract - A wireless meter-reading system includes a utility meter having a housing and a face and a recording device located in the housing. The recording device is adapted to read and convert data located on a portion of the face to wirelessly transmittable data. A power source coupled to the recording device permits continuous and instantaneous capture of the wirelessly transmittable data from the face of the utility meter by the recording device. A communication device provided for wirelessly receiving and transmitting data between a consumer site and a utility provider site facilitates monitoring of the face of the utility meter by the consumer site and by the utility provider site. A method for allowing a consumer to join a secured wireless network of a utility provider comprises the consumer paying a fee to the utility provider. Both the consumer and the utility provider benefit from this arrangement.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply to a residential home or industrial/commercial facility or building;	Fig. 4, Col. 6. lines 53-55 It is understood that without limitation the utility meter 12 may comprise at least one of an electric meter, a gas meter, a water meter, and the like.
said remotely controllable base station with a said water shutt-off/on mechanism adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	
an alarm or computer system;	
said remotely controllable base station include a recording compliance data means;	
said alarm or computer system includes electronic circuitry to send a wireless signal to said remotely controllable base statio to turn said water supply on and off, said wireless signal utilizing encrytion, authentic, integrity and/or non-repudiate technology, and	Col. 6, lines 3-19 Alternatively, the communication device 30 may be at least one of a satellite (depicted as a portion of a block diagram denoted "receiver and transmitter") and a cell phone network (depicted as a portion of a block diagram denoted "receiver and transmitter"), and the like. The communication device 30 is wirelessly coupled to the recording device 12 (such as a wireless cell phone). It is understood that when the communication device 30 is coupled to a wireless cell phone, the wireless cell phone further comprises at least a recording device 12 such as a digital camera, and the like. The wireless cell phone may be programmed to respond to transmissions from both the customer site 36 and the utility company site 38. Each one of the satellite and the cell phone network is adapted to relay data from the recording device 12 located in

	the housing 22 of the utility meter 14 to the consumer site 36 and to the utility provider site 38. **(No encryption, authentication, integrity and/or non-repudiation technology)**
said alarm or computer system having the capability to receive a wireless electronic communication whereby said alarm or computer includes an indicating means for determining an operational state or position of the shut-off/on mechansim.	
'150 Claim 23 CC3 - **(Newly Added Claim)**	
23. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.	
'150 Claim 26 CC1 - **(Newly Added Claim)**	
26. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station requires an intial pairing technology to provide a specific wireless communication means between with said alarm or computer system and said remotely controllable base station.	
'150 Claim 28 CC3	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

CC4

US. Patent 9,297,150 Claim Chart – Blackwell 8,644,804

'150 Claim 8 CC4	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A method and a system for collection of meter readings from meter reading and transmitting devices (12, 14) and for viewing on a web-enabled wireless communication device (28) comprises addressing at least one receiver (15) through the Internet (21) and obtaining a data file of meter data for a plurality of meter reading devices (12, 14) that have previously communicated with the receiver (15). The receiver (15) can then re-transmit the meter data through a wide area network such as the Internet (21) to a web site (10) operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone (28) which receives a web page (22) that is reduced in size for transmission through the cellular network to the smart phone (28).
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 2, lines 55-58 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 1, lines 59-64 The wireless communication device is preferably a web-enabled wireless communication device, such as a Blackberry web-enabled cellular phone, another web-enabled cellular phone or personal digital assistant (PDA).
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	Col. 2, lines 55-58 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
'150 Claim 9 CC4	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC4	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC4	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC4	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC4	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC4	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC4	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 1, lines 53-58 The method and system of the present invention can run on a web site that can be reached through a GSM or other cellular network. The method of the invention further includes reading a file of meter data in the form of an HTML web page, which is then modified for viewing on a web-enabled handheld wireless communication device.
'150 Claim 16 CC4	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC4	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC4	
18. A building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	Col. 2, lines 39-41 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 21.

'150 Claim 19 CC4	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC4	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 21 CC4 - **(Newly Added Claim)**	
A building or structure water damage prevention system, said system comprising:	Abstract - A method and a system for collection of meter readings from meter reading and transmitting devices (12, 14) and for viewing on a web-enabled wireless communication device (28) comprises addressing at least one receiver (15) through the Internet (21) and obtaining a data file of meter data for a plurality of meter reading devices (12, 14) that have previously communicated with the receiver (15). The receiver (15) can then re-transmit the meter data through a wide area network such as the Internet (21) to a web site (10) operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone (28) which receives a web page (22) that is reduced in size for transmission through the cellular network to the smart phone (28).
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply to a residential home or industrial/commercial facility or building;	
said remotely controllable base station with a said water shutt-off/on mechanism adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 2, lines 55-58 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
an alarm or computer system;	
said remotely controllable base station include a recording compliance data means;	
said alarm or computer system includes electronic circuitry to send a wireless signal to said remotely	

controllable base statio to turn said water supply on and off, said wireless signal utilizing encrytion, authentic, integrity and/or non-repudiate technology, and	
said alarm or computer system having the capability to receive a wireless electronic communication whereby said alarm or computer includes an indicating means for determining an operational state or position of the shut-off/on mechansim.	
'150 Claim 23 CC4 - **(Newly Added Claim)**	
23. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.	
'150 Claim 26 CC4 - **(Newly Added Claim)**	
26. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station requires an intial pairing technology to provide a specific wireless communication means between with said alarm or computer system and said remotely controllable base station.	
'150 Claim 28 CC4	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	Col. 2, lines 39-41 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 21.

CC5

US. Patent 9,297,150 Claim Chart – Ball 8,833,390

'150 Claim 8 CC5	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A valve meter device, assembly, and method is disclosed including a housing defining at least one inlet opening and at least one outlet opening and a channel connecting the openings, the at least one inlet opening having an inlet end and the at least one outlet opening having an outlet end; a water meter positioned in the channel, the water meter configured to monitor a flow of water through the valve meter device; and a valve in communication with the channel and configured to control the flow of water through the valve meter device. In some embodiments, a linear distance exists between the inlet end and the outlet end, the linear distance being no greater than a standard water meter lay-length.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	Figs. 3, 4, 5, 6, Col. 4, lines 39-43, The inlet threaded portion 315 and the outlet threaded portion 325 allow for attachment to a piping system, including an upstream piping system or a downstream piping system or both.
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 3, line 18-20 Disclosed is a valve meter device, a valve meter assembly, and a method for remotely reading a water meter and controlling a water supply valve.
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC5	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC5	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC5	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC5	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC5	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC5	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC5	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	
'150 Claim 16 CC5	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC5	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC5	
18. A building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	
'150 Claim 19 CC5	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	

'150 Claim 20 CC5	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 21 CC5 - - **(Newly Added Claim)**	
A building or structure water damage prevention system, said system comprising:	Abstract - A valve meter device, assembly, and method is disclosed including a housing defining at least one inlet opening and at least one outlet opening and a channel connecting the openings, the at least one inlet opening having an inlet end and the at least one outlet opening having an outlet end; a water meter positioned in the channel, the water meter configured to monitor a flow of water through the valve meter device; and a valve in communication with the channel and configured to control the flow of water through the valve meter device. In some embodiments, a linear distance exists between the inlet end and the outlet end, the linear distance being no greater than a standard water meter lay-length.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply to a residential home or industrial/commercial facility or building;	Figs. 3, 4, 5, 6, Col. 4, lines 39-43, The inlet threaded portion 315 and the outlet threaded portion 325 allow for attachment to a piping system, including an upstream piping system or a downstream piping system or both.
said remotely controllable base station with a said water shut-off/on mechanism adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 3, line 18-20 Disclosed is a valve meter device, a valve meter assembly, and a method for remotely reading a water meter and controlling a water supply valve.
an alarm or computer system;	
said remotely controllable base station include a recording compliance data means;	
said alarm or computer system includes electronic circuitry to send a wireless signal to said remotely controllable base statio to turn said water supply on and off, said wireless signal utilizing encrytion, authentic, integrity and/or non-repudiate technology, and	
said alarm or computer system having the capability to receive a wireless electronic communication whereby said alarm or computer includes an indicating means for determining an operational state or position of the shut-off/on mechansim.	

'150 Claim 23 CC5 - **(Newly Added Claim)**	
23. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.	
'150 Claim 26 CC5 - **(Newly Added Claim)**	
26. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station requires an intial pairing technology to provide a specific wireless communication means between with said alarm or computer system and said remotely controllable base station.	
'150 Claim 28 CC5	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

CC6

US. Patent 9,297,150 Claim Chart – Broniak 9,019,120

'150 Claim 8 CC6	
A building or structure water damage prevention system, said system comprising:	Abstract - Methods and systems are disclosed for monitoring water leaks within a home. A home network with various devices monitors these devices with a controller.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	Col. 3, line 36-40 - A main water meter 52 is operatively connected to the main water inlet pipe 50 for measuring a total amount of water flow into the home and communicating information gathered to the controller 10 via a communication module 56.
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Abstract - A shut off valve can be triggered remotely when a request is received from the user, which closes the water pipeline to prevent water damage. Col. 5, lines 10-24 … the system 8 includes shut off valves 58, 68, and 78 at respective pipelines 50, 60 and 70. The central controller 10 may receive input from the user or homeowner in response to the warning or message, and the user, for example, may respond with instructions to shut off the pipelines 50, 60, and/or 70 via the respective shut off valve 58, 68 and 78
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Fig. 1, Col. 5 lines 59-67 and Col. 6, lines 1-2 Referring back to FIG. 1, the controller 10 further comprises a memory 30 having at least table 32 that collects water consumption data, energy consumption, generation and/or storage data for a home or other structure (e.g., warehouse, business, etc.). The table may additionally comprise variables associated with the heating and cooling conditions of the home, for example. A table is generated for each monitored device that includes historical home data and data that is currently updated, which may be used in a client application running on a device, such as a computer or mobile phone, for presenting graphs or other data to the user.
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC6	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC6	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC6	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC6	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	Col. 5, lines 1-5 For example, if a water flow in pipeline 70 is determined to have a leak, then a text message, email, and/or a user display message may be transmitted via the internet or on the user display 22 to inform the homeowner of a leak.
'150 Claim 13 CC6	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC6	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC6	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 2, lines 3-6 In one embodiment, a home network with a central controller includes at least one water meter or flow meter for measuring water that is consumed by a water consuming device. Col. 1, lines 60-64 The present disclosure provides a method for use within an energy management system that alerts the homeowner of a potential water leak. A central controller (e.g., a home energy manager) communicates wired/wireless signals to one or more water meters coupled to a main water pipeline and/or to various water consuming devices, such as a washer, dishwasher, sinks, toilet, etc throughout the home.
'150 Claim 16 CC6	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC6	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC6	
18. A building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	Fig. 2, Col. 5, lines 25-34 A central controller of a home network communicates wirelessly, for example, to radios that are connected to various sensors. There are several ways to accomplish this communication, including but not limited to power line carrier (PLC) (also known as power line communication), FM, AM SSB, WiFi, ZigBee, Radio Broadcast Data System, 802.11, 802.15.4, etc.

'150 Claim 19 CC6	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC6	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	Col. 5, lines 11-21 The central controller 10 may receive input from the user or homeowner in response to the warning or message, and the user, for example, may respond with instructions to shut off the pipelines 50, 60, and/or 70 via the respective shut off valve 58, 68 and 78. In this manner, leaks are detected within a home and homeowners are informed of the conditions in which the water consuming devices operate. Informed decisions regarding water usage are made by the homeowner and potentially catastrophic water destruction in a home is more easily avoided.
'150 Claim 21 CC6 - **(Newly Added Claim)**	
A building or structure water damage prevention system, said system comprising:	Abstract - Methods and systems are disclosed for monitoring water leaks within a home. A home network with various devices monitors these devices with a controller.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply to a residential home or industrial/commercial facility or building;	Col. 3, line 36-40 - A main water meter 52 is operatively connected to the main water inlet pipe 50 for measuring a total amount of water flow into the home and communicating information gathered to the controller 10 via a communication module 56.
said remotely controllable base station with a said water shutt-off/on mechanism adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Abstract - A shut off valve can be triggered remotely when a request is received from the user, which closes the water pipeline to prevent water damage. Col. 5, lines 10-24 … the system 8 includes shut off valves 58, 68, and 78 at respective pipelines 50, 60 and 70. The central controller 10 may receive input from the user or homeowner in response to the warning or message, and the user, for example, may respond with instructions to shut off the pipelines 50, 60, and/or 70 via the respective shut off valve 58, 68 and 78
an alarm or computer system;	
said remotely controllable base station include a recording compliance data means;	
said alarm or computer system includes electronic circuitry to send a wireless signal to said remotely controllable base statio to turn said water supply on	

and off, said wireless signal utilizing encrytion, authentic, integrity and/or non-repudiate technology, and	
said alarm or computer system having the capability to receive a wireless electronic communication whereby said alarm or computer includes an indicating means for determining an operational state or position of the shut-off/on mechansim.	
'150 Claim 23 CC6 - **(Newly Added Claim)**	
23. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.	
'150 Claim 26 CC6 - **(Newly Added Claim)**	
26. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station requires an intial pairing technology to provide a specific wireless communication means between with said alarm or computer system and said remotely controllable base station.	
'150 Claim 28 CC6	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

CC7

US. Patent 9,297,150 Claim Chart – Blackwell 9,709421

'150 Claim 8 CC7	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A method and a system for collection of meter readings from meter reading and transmitting devices (12, 14) and for viewing on a web-enabled wireless communication device (28) comprises addressing at least one receiver (15) through the Internet (21) and obtaining a data file of meter data for a plurality of meter reading devices (12, 14) that have previously communicated with the receiver (15). The receiver (15) can then re-transmit the meter data through a wide area network such as the Internet (21) to a web site (10) operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone (28) which receives a web page (22) that is reduced in size for transmission through the cellular network to the smart phone (28).
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	Col. 2, lines 59-63 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 2, lines 59-63 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 1, lines 59-65 The wireless communication device is preferably a web-enabled wireless communication device, such as a Blackberry web-enabled cellular phone, another web-enabled cellular phone or personal digital assistant (PDA).
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	Col. 2, lines 55-63 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data
'150 Claim 9 CC7	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC7	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC7	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC7	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC7	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC7	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC7	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 2, lines 4-12 The invention provides a demonstration tool that can be operated at a customer demonstration site by a sales person as part of a customer presentation without requiring assistance from engineering personnel as practiced in the prior art. The use of a Web application on a web-enabled telephone simulates collection of data at a utility collection site. This will demonstrate the capabilities of the AMR-networked system prior to purchase by utility customers and installation at their premises.
'150 Claim 16 CC7	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC7	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC7	
18. A building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	Col. 2, lines 43-49 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 2

'150 Claim 19 CC7	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC7	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	Col. 2, lines 56- 63 As used herein, the term "meter data" should be understood to include either utility consumption data or condition status data, or both. Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
'150 Claim 21 CC7 - **(Newly Added Claim)**	
A building or structure water damage prevention system, said system comprising:	Abstract - A method and a system for collection of meter readings from meter reading and transmitting devices (12, 14) and for viewing on a web-enabled wireless communication device (28) comprises addressing at least one receiver (15) through the Internet (21) and obtaining a data file of meter data for a plurality of meter reading devices (12, 14) that have previously communicated with the receiver (15). The receiver (15) can then re-transmit the meter data through a wide area network such as the Internet (21) to a web site (10) operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone (28) which receives a web page (22) that is reduced in size for transmission through the cellular network to the smart phone (28).
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply to a residential home or industrial/commercial facility or building;	Col. 2, lines 59-63 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
said remotely controllable base station with a said water shut-off/on mechanism adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 2, lines 59-63 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
an alarm or computer system;	
said remotely controllable base station include a recording compliance data means;	
said alarm or computer system includes electronic circuitry to send a wireless signal to said remotely	

controllable base statio to turn said water supply on and off, said wireless signal utilizing encrytion, authentic, integrity and/or non-repudiate technology, and	
said alarm or computer system having the capability to receive a wireless electronic communication whereby said alarm or computer includes an indicating means for determining an operational state or position of the shut-off/on mechansim.	
'150 Claim 23 CC1 - **(Newly Added Claim)**	
23. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.	
'150 Claim 26 CC1 - **(Newly Added Claim)**	
26. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station requires an intial pairing technology to provide a specific wireless communication means between with said alarm or computer system and said remotely controllable base station.	
'150 Claim 28 CC7	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	Col. 2, lines 43-49 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 2

<u>CC8</u>

US. Patent 9,297,150 Claim Chart – Palayur 2011/0035063

'150 Claim 8 CC8	
8. A building or structure water damage prevention system, said system comprising:	Abstract - This invention is a water consumption monitoring and control system comprised of a base unit, itself comprising a display and a data entry device, a microprocessor, a communication link to water meters, pressure sensors, temperature sensors, flush toilet vibration sensors and shut-off valves. In addition, the base unit has access to the Internet and can access a server which holds a database of water conservation information.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	Col. 4, lines 31-33 - As illustrated in FIG. 3, the device housing 110 has an inlet 310 and an outlet 320. Water flows through the device housing 110 by flowing into the inlet 310 and the out of the outlet 320.
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 4, lines 31-33 - As illustrated in FIG. 3, the device housing 110 has an inlet 310 and an outlet 320. Water flows through the device housing 110 by flowing into the inlet 310 and the out of the outlet 320.
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 1, lines 59-64 The wireless communication device is preferably a web-enabled wireless communication device, such as a Blackberry web-enabled cellular phone, another web-enabled cellular phone or personal digital assistant (PDA).
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	Fig. 1, Paragraph 50 d) Communication links to several entities located on the Web in particular a server 9, a utility company 14 (water company), a weather information service 15 and user mobile communication devices (e.g., cell phones) **No disclose of an APP**
said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	Col. 2, lines 55-58 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.

'150 Claim 9 CC8	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC8	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC8	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC8	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC8	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	
'150 Claim 14 CC8	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	

'150 Claim 15 CC8	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 1, lines 53-58 The method and system of the present invention can run on a web site that can be reached through a GSM or other cellular network. The method of the invention further includes reading a file of meter data in the form of an HTML web page, which is then modified for viewing on a web-enabled handheld wireless communication device.
'150 Claim 16 CC8	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC8	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC8	
18. A building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	Col. 2, lines 39-41 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 21.
'150 Claim 19 CC8	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	

'150 Claim 20 CC8	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 21 CC8 - **(Newly Added Claim)**	
A building or structure water damage prevention system, said system comprising:	Abstract - This invention is a water consumption monitoring and control system comprised of a base unit, itself comprising a display and a data entry device, a microprocessor, a communication link to water meters, pressure sensors, temperature sensors, flush toilet vibration sensors and shut-off valves. In addition, the base unit has access to the Internet and can access a server which holds a database of water conservation information.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply to a residential home or industrial/commercial facility or building;	Col. 4, lines 31-33 - As illustrated in FIG. 3, the device housing 110 has an inlet 310 and an outlet 320. Water flows through the device housing 110 by flowing into the inlet 310 and the out of the outlet 320.
said remotely controllable base station with a said water shutt-off/on mechanism adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 4, lines 31-33 - As illustrated in FIG. 3, the device housing 110 has an inlet 310 and an outlet 320. Water flows through the device housing 110 by flowing into the inlet 310 and the out of the outlet 320.
an alarm or computer system;	
said remotely controllable base station include a recording compliance data means;	
said alarm or computer system includes electronic circuitry to send a wireless signal to said remotely controllable base statio to turn said water supply on and off, said wireless signal utilizing encrytion, authentic, integrity and/or non-repudiate technology, and	
said alarm or computer system having the capability to receive a wireless electronic communication whereby said alarm or computer includes an indicating means for determining an operational state or position of the shut-off/on mechansim.	
'150 Claim 23 CC8 - **(Newly Added Claim)**	
23. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.	

'150 Claim 26 CC8 - **(Newly Added Claim)**	
26. A building or structure water damage prevention system as recited in claim 21, wherein said remotely controllable base station requires an intial pairing technology to provide a specific wireless communication means between with said alarm or computer system and said remotely controllable base station.	
'150 Claim 28 CC8	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	Col. 2, lines 39-41 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 21.

Electronic Acknowledgement Receipt	
EFS ID:	37577137
Application Number:	90014354
International Application Number:	
Confirmation Number:	1805
Title of Invention:	WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM
First Named Inventor/Applicant Name:	99297150
Customer Number:	22509
Filer:	Michael E. Klicpera
Filer Authorized By:	
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Receipt Date:	28-OCT-2019
Filing Date:	02-AUG-2019
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Supplemental Response or Supplemental Amendment	150_Patent_Supplemental_Reexamination_Cover_Letter.pdf	246779 bf4cebcc27f3b531f9fded4df71bf5bc909d164a	no	1

Warnings:

Information:					
2	Supplemental Response or Supplemental Amendment	CC1_Supplemental.pdf	2369300 95b5948af272a9bcea255094a1775fa8348abc8b	no	7
Warnings:					
Information:					
3	Supplemental Response or Supplemental Amendment	CC2_Supplemental.pdf	2082998 928161c4d53b47f8385b45edf433c3258f804a15	no	6
Warnings:					
Information:					
4	Supplemental Response or Supplemental Amendment	CC3_Supplemental.pdf	2465864 1fd0a1baa63991cc0ff22192ccad7189b120351a	no	7
Warnings:					
Information:					
5	Supplemental Response or Supplemental Amendment	CC4_Supplemental.pdf	2254462 c8d362534429e3937b3fc2466474e111690f7b81	no	6
Warnings:					
Information:					
6	Supplemental Response or Supplemental Amendment	CC5_Supplemental.pdf	2025804 f99d5bc157f06ec46985c1c16643efd0424ae896	no	6
Warnings:					
Information:					
7	Supplemental Response or Supplemental Amendment	CC6_Supplemental.pdf	2350465 9edd2fe2d15e403363cc99ca80a3200060723d11	no	6
Warnings:					
Information:					
8	Supplemental Response or Supplemental Amendment	CC7_Supplemental.pdf	2364310 77f76808f5a54e4946f3f688d3eb97b530495ae4	no	6
Warnings:					
Information:					

9	Supplemental Response or Supplemental Amendment	CC8_Supplemental.pdf	2232219 1afbc6ab7d7ee4d5cd5ee274faf85d039d9b92f7	no	6
Warnings:					
Information:					
		Total Files Size (in bytes):	18392201		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/014,354	08/02/2019	99297150	70947.01	1805

22509 7590 09/10/2019
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EXAMINER	
RIMELL, SAMUEL G	
ART UNIT	**PAPER NUMBER**
3992	
MAIL DATE	**DELIVERY MODE**
09/10/2019	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Order Granting Request For Ex Parte Reexamination	**Control No.** 90/014,354	**Patent Under Reexamination** 9297150	
	Examiner SAM RIMELL	**Art Unit** 3992	**AIA (FITF) Status** No

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

The request for *ex parte* reexamination filed 08/02/2019 has been considered and a determination has been made. An identification of the claims, the references relied upon, and the rationale supporting the determination are attached.

Attachments: a)☐ PTO-892, b)☑ PTO/SB/08, c)☐ Other: ____

1. ☑ The request for *ex parte* reexamination is GRANTED.

RESPONSE TIMES ARE SET AS FOLLOWS:

For Patent Owner's Statement (Optional): TWO MONTHS from the mailing date of this communication (37 CFR 1.530 (b)). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).**

For Requester's Reply (optional): TWO MONTHS from the **date of service** of any timely filed Patent Owner's Statement (37 CFR 1.535). **NO EXTENSION OF THIS TIME PERIOD IS PERMITTED.** If Patent Owner does not file a timely statement under 37 CFR 1.530(b), then no reply by requester is permitted.

/SAMUEL G RIMELL/ Primary Examiner, Art Unit 3992	/ANGELA M LIE/ Primary Examiner, Art Unit 3992	

cc:Requester (if third party requester)

DECISION GRANTING EX PARTE REEXAMINATION

The Request filed August 15, 2019 asserts that substantial questions of patentability (SNQ) affecting claims 8-19 and 28 of the U.S. Patent Number 9,297,150 are raised by the following prior art references. Each reference listed is admitted to be prior art under 35 USC §102 and 35 USC §103 (Request at pp.2-3, Table of Exhibits, Section C):

1. US Patent 5,719,564 to Sears, issued February 17, 1998 and filed May 10, 1996.

2. US Patent 6,181,257 to Meek et al, issued January 30, 2001, filed August 31, 1998 and effective priority claim to September 29, 1994.

3. US Patent 7,310,052 to Bowman, issued December 18, 2007, filed July 6, 2005.

4. US Patent 8,644,804 to Blackwell et al, issued February 4, 2014, filed October 2, 2009.

5. US Patent 8,833,390 to Ball et al, issued September 16, 2014, filed May 31, 2011.

6. US Patent 9,019,120 to Broniak et al, issued April 28, 2015, filed November 9, 2010.

7. US Pre-Grant Publication 2011/0035063 to Palayur[1] published February 10, 2011, filed October 14, 2010, effective priority claim to October 20, 2009.

8. US Patent 9,709,421 to Blackwell et al, published July 18, 2017, filed February 3, 2014 with effective priority claim to October 2, 2009.

Brief Overview of the US Patent 9,297,150

The invention is a water damage prevention system that has a residential or industrial or commercial facility water supply interruption system. The system is comprised of a remotely controllable base station with shut-off/on mechanism that is in wireless or wired communication with a convenient controller. The base station with shut-off/on mechanism is interposed within a water line from a water main to the living or operating quarters portion of a residential or an

[1] It is observed that Applicant's Request at page 2 appears to inadvertently list the same Palayur et al reference as two separate references, but otherwise, this has no effect on the questions (SNQs) being considered.

industrial or commercial facility or building, such that activation of the base station with shut-off/on valve operates to prevent flow of water from the water main to the living quarters when the residential home or industrial/commercial facility or building is vacated or unsupervised. In this manner, damage to the living quarters or the industrial/commercial facility or building from failure of water pipes running through the living or working quarters is prevented during times that the shut-off mechanism is activated (see abstract).

Prosecution History of US Patent 9,297,150

The following applications establish the chain of priority claims in the prior continuation in part (CIP) of divisional applications (DIV) leading up to the issuance of US Patent 9.297,150:

Priority Claim Chart

Serial Number	Filing Date	Patent	Issue Date	Abandon Date
13/776,963 (CIP)	2/26/2013	9,297,150	3/29/2016	
61/729,653 (PRO)	11/26/2012			11/26/2013
13/541,819 (CIP)	7/5/2012			12/17/2015
13/216,497 (CIP)	8/24/2011	8,887,324	11/18/2014	
13/216,521 (CIP)	8/24/2011	8,347,427	1/8/2013	
12/986,341 (CIP)	1/8/2011			8/29/2017
12/877,094 (CIP)	9/7/2010	9,266,136	2/23/2016	
12/539,150 (DIV)	8/11/2009	9,061,307	6/23/2015	
11/877,860	10/24/2007	9,254,499	2/9/2016	

The final application in the chain of applications leading up to the issuance of US patent 9,297,150 was application 13/776,963, filed on February 26, 2013.

The USPTO mailed a non-final action in this application on January 29, 2015. Claims 1-27 were rejected under 35 USC §112. Claims 24 and 26 were rejected under 35 USC §102(b) as anticipated by Gosecko (US Pre-Grant Publication 2011/0114202). Claims 1 and 3-9 were rejected under 35 USC 103 as being unpatentable over Gosecko (US Pre-Grant Publication 2011/0114202) in view of Hollingsworth (US Patent 7,147,204). Claim 2 was rejected under 35 USC 103 as being unpatentable over Gosecko (US Pre-Grant Publication 2011/0114202) in view of Hollingsworth (US Patent 7,147,204) and Richter (US Patent 6,532,979). Claims 10, 12-14 and 16-23 were rejected under 35 USC 103 as being unpatentable over Gosecko (US Pre-Grant Publication 2011/0114202) in view of Affatacati (US Patent 7,559,529). Claim 11 was rejected under 35 USC 103 as being unpatentable over Gosecko (US Pre-Grant Publication 2011/0114202) in view of Affatacati (US Patent 7,559,529) and Richter (US Patent 6,532,979). Claim 15 was rejected under 35 USC 103 as being unpatentable over Gosecko (US Pre-Grant Publication 2011/0114202) in view of Affatacati (US Patent 7,559,529) and Reeder (US Patent 8,028,355). Claims 25 and 27 were rejected under 35 USC 103 as being unpatentable over Gosecko (US Pre-Grant Publication 2011/0114202) in view of Wilson (US Patent 7,900,650).

Applicant submitted a response with amendments on July 24, 2015. Each of claims 1-27 were amended. New claims 28-30 were added.

Applicant submitted a supplemental response on August 18, 2015, with amendments to the specification.

The USPTO mailed a final office action on August 31, 2015. Claims 1-30 were rejected under 35 USC 112, first paragraph and second paragraph. Claims 24, 26 and 29 were rejected under 35 USC 103 as obvious over Kushner (US Patent 6,237,618) and Jeffries (US Pre-Grant

Publication 2006/0137090). The office action also indicates allowable subject matter relative to the prior art, which reads as follows:

"The following is a statement of reasons for the indication of allowable subject matter: the prior art fails to disclose or render obvious in independent claims 1,10 and 25 "said remote controllable base station including a recording compliance data means" in combination with the other limitations set forth in the respective independent claims. In each independent claim, the combination of the remote controllable base station via the wireless key chain/fob, garage door opener, or smart phone, with the above recording compliance data means in combination with all the other limitations as arranged and configured in the respective independent claims, requires using the claims as a roadmap to make obvious the claimed arrangements, an accordingly it would not have been obvious to one of ordinary skill in the art to provide such a claimed arrangement especially without improper hindsight construction on the same. Thus, absent the rejections above under 35 USC 112 and any objections, the above independent claims would be allowable."

Applicant filed a first after final response with remarks and claim amendments on October 7, 2015. This was initially denied entry, as indicated by the USPTO Advisory Action on October 19, 2015.

Applicant filed a second after final response with remarks and claim amendments on October 27, 2015. This was followed by a Notice of Allowance on November 6, 2015. Reasons for Patentability reference back to the statement of allowable subject matter in the final office action.

Effective Filing Date of Claims Requested for Reexamination

Requester seeks reexamination of claims 8-19 and 28 of US Patent 9,297,150. The effective filing date for this claim set is February 26, 2013, which corresponds to the filing date of 13/776,963, which matured directly into US Patent 9,297,150.

Specifically, the "garage door opener" recited in independent claim 8 only first appears in application 13/776,963. Additionally, 13/776,963 is specifically identified as a CIP application. As a result, the effective filing date for claim 8 is February 26, 2013. Since 9-19 and 28 incorporate by reference the subject matter of claim 8, these claims carry the same effective filing date.

Each prior art reference asserted by applicant is available as prior art under 35 USC §102 and 35 USC §103, based on the effective filing date.

Treatment of Preliminary Amendments

For purposes of evaluating substantial new questions of patentability (SNQs), only the content of the original patent are considered. As a result, preliminary amendments to either the specification or the claims are not considered at this initial stage of the reexamination. See MPEP 2243, last paragraph, and 37 CFR 1.515(a).

Substantial New Questions of Patentability (SNQs) Asserted in the Request

SNQ #1: Whether Sears raises an SNQ in view of claims 8-19 and 28 of US Patent 9,297,150.

SNQ #2: Whether Meek et al raises an SNQ in view of claims 8-19 and 28 of US Patent 9,297,150.

SNQ #3: Whether Bowman raises an SNQ in view of claims 8-19 and 28 of US Patent 9,297,150.

SNQ #4: Whether Blackwell et al ('804) raises an SNQ in view of claims 8-19 and 28 of US Patent 9,297,150.

SNQ #5: Whether Ball et al raises an SNQ in view of claims 8-19 and 28 of US Patent 9,297,150.

SNQ #6: Whether Broniak et al raises an SNQ in view of claims 8-19 and 28 of US Patent 9,297,150.

SNQ #7: Whether Blackwell et al ('421) raises an SNQ in view of claims 8-19 and 28 of US Patent 9,297,150.

SNQ #8: Whether Palayur raises an SNQ in view of claims 8-19 and 28 of US Patent 9,297,150.

Legal Standard for a Substantial New Question of Patentability (SNQ)

The legal standard for ordering *ex parte* reexamination, as set forth in 35 U.S.C. 303(a), requires a substantial new question of patentability.

A prior art patent or printed publication raises a substantial question of patentability where there is a substantial likelihood that a reasonable examiner would consider the prior art patent or printed publication important in deciding whether or not the claim is patentable. If the prior art patents and/or publications would be considered important, then the examiner should find "a substantial new question of patentability" unless the same question of patentability has already been decided as to the claim in a final holding of invalidity by a federal court or by the Office in an earlier concluded examination or review of the patent, or unless the same question of patentability has been raised to or by the Office in a pending reexamination or supplemental examination of the patent.

The substantial new question of patentability may be based on art previously considered by the Office if the reference is presented in a new light or a different way that escaped review during earlier examination. The clarification of the legal standard for determining obviousness under 35 U.S.C. 103 in *KSR International Co. v. Teleflex Inc.* (KSR), 550 U.S. 398, 82 USPQ2d 1385 (2007) does not alter the legal standard for determining whether a substantial new question of patentability exists. The requirement for a substantial new question of patentability remains in place even if it is clear from the record of a patent for which reexamination is requested that the patent was granted because the Office did not show "motivation" to combine, or otherwise satisfy the teaching, suggestion, or motivation (TSM) test. Thus, a reexamination request relying on previously applied prior art that asks the Office to look at the art again based solely on the Supreme Court's clarification of the legal standard for determining obviousness under 35 U.S.C. 103 in *KSR*, without presenting the art in new light or different way, will not raise a substantial new question of patentability as to the patent claims, and reexamination will not be ordered.

After the enactment of the Patent and Trademark Office Authorization Act of 2002 ("the 2002 Act"), a substantial new question of patentability can be raised by patents and printed publications "previously cited by or to the Office or considered by the Office" ("old art"). The 2002 Act did not negate the statutory requirement for a substantial new question of patentability that requires raising new questions about pre-existing technology. In the implementation of the 2002 Act, MPEP § 2242, subsection II.A was revised. The revision permits raising a substantial new question of patentability based solely on old art, but only if the old art is "presented/viewed in a new light, or in a different way, as compared with its use in the earlier examination(s), in view of a material new argument or interpretation presented in the request." Thus, a request may

properly raise a substantial new question of patentability by raising a material new analysis of previously considered reference(s) under the rationales authorized by *KSR*.

Analysis of SNQ Issues

SNQ #1: Does Sears raise an SNQ with respect to claims 8-19 and 28?

FIG 5 of Sears refers to a " data accumulator" and block 130 of FIG 5 recites: "enable top ranked data accumulator to record and store signals from particular meter module". Such a data accumulator thus corresponds to a "*recording compliance means*" as set forth in claim 8 of US Patent 9,927,150. Additionally in Sears, the block 14 corresponds to an electronic transmitting and "*remotely controllable base station*" as set forth in claim 8 of the '150 patent. FIG 1 of Sears also illustrates "*cell phones*" as recited in claim 8 of the '150 patent.

There is a substantial likelihood that a reasonable examiner would consider the Sears patent important in deciding whether or not the claim is patentable. The same question of patentability has not already been decided as to the claim in a final holding of invalidity by a federal court or by the Office in an earlier concluded examination or review of the '150 patent. The same question of patentability has not been raised to or by the Office in a pending reexamination or supplemental examination of the '150 patent.

Accordingly, Sears raises an SNQ with respect to claim 8. Since each of claims 9-19 and 28 incorporate the subject matter of claim 8 by reference, an SNQ is additionally raised by Sears for this set of dependent claims.

SNQ #2: Does Meek et al raise an SNQ with respect to claims 8-19 and 28?

FIG 10 of Meek et al teaches a "usage counter" and "usage memory" which stores data from the usage counter. The usage counter records clock pulses produced during usage of the utility data gathering system (col. 23, line 58 though col. 24, line 8). The usage counter and usage

memory thus corresponds to a "*recording compliance means*" as set forth in claim 8 of US Patent 9,927,150. Additionally in Meek et al, FIG 1, the transponder/interrogator corresponds to an electronic transmitting and "*remotely controllable base station*" as set forth in claim 8 of the '150 patent.

There is a substantial likelihood that a reasonable examiner would consider the Meek et al patent important in deciding whether or not the claim is patentable. The same question of patentability has not already been decided as to the claim in a final holding of invalidity by a federal court or by the Office in an earlier concluded examination or review of the '150 patent. The same question of patentability has not been raised to or by the Office in a pending reexamination or supplemental examination of the '150 patent.

Accordingly, Meek et al raises an SNQ with respect to claim 8. Since each of claims 9-19 and 28 incorporate the subject matter of claim 8 by reference, an SNQ is additionally raised by Meek et al for this set of dependent claims.

SNQ #3: Does Bowman raise an SNQ with respect to claims 8-19 and 28?

FIG 5 of Bowman illustrates a "receiver and transmitter 30" which is controllable by a remote customer site 36. Accordingly, the "receiver and transmitter 30" corresponds to a "*remotely controllable base station*" as set forth in claim 8 of the '150 patent. Referring back to FIG 5 of Bowman, web cameras 12 record utility meter data and transmit that data to the receiver and transmitter 30. Accordingly, the web cameras 12 correspond to a "*recording compliance means*" as set forth in claim 8 of US Patent 9,927,150. Additionally, col. 6, lines 9-10 teach that the web cameras 12 can also be a "*cell phone*" as recited in claim 8 of the '150 patent.

There is a substantial likelihood that a reasonable examiner would consider the Bowman patent important in deciding whether or not the claim is patentable. The same question of

patentability has not already been decided as to the claim in a final holding of invalidity by a federal court or by the Office in an earlier concluded examination or review of the '150 patent. The same question of patentability has not been raised to or by the Office in a pending reexamination or supplemental examination of the '150 patent.

Accordingly, Bowman raises an SNQ with respect to claim 8. Since each of claims 9-19 and 28 incorporate the subject matter of claim 8 by reference, an SNQ is additionally raised by Bowman for this set of dependent claims.

SNQ #4: Does Blackwell et al ('804) raises an SNQ in view of claims 8-19 and 28?

FIG 1 of Blackwell ('804) illustrates a "utility meter RF transmitter 12" which is controllable via a web page accessed by a customer through a web server 11. Accordingly, the "utility meter RF transmitter 12" corresponds to a "*remotely controllable base station*" as set forth in claim 8 of the '150 patent. Referring to FIG 2 of Blackwell ('804), a data record is created with a time stamp 31, header 32, status 34 and a meter reading 35. Either the data record or the computer structure creating this data record corresponds to a "*recording compliance means*" as set forth in claim 8 of US Patent 9,927,150. Additionally, FIG 1 teaches a wireless cell phone 28 that corresponds to the "*cell phone*" as recited in claim 8 of the '150 patent.

There is a substantial likelihood that a reasonable examiner would consider the Blackwell ('804) patent important in deciding whether or not the claim is patentable. The same question of patentability has not already been decided as to the claim in a final holding of invalidity by a federal court or by the Office in an earlier concluded examination or review of the '150 patent. The same question of patentability has not been raised to or by the Office in a pending reexamination or supplemental examination of the '150 patent.

Accordingly, Blackwell ('804) raises an SNQ with respect to claim 8. Since each of claims 9-19 and 28 incorporate the subject matter of claim 8 by reference, an SNQ is additionally raised by Blackwell ('804) for this set of dependent claims.

SNQ #5: Does Ball et al raise an SNQ in view of claims 8-19 and 28?

FIG 29 of Ball et al illustrates a "wireless communication unit 2310" which is remotely controllable through remotely located communicators 2985' and 2985''. Accordingly, the "wireless communication unit 2310" corresponds to a "*remotely controllable base station*" as set forth in claim 8 of the '150 patent. Referring to FIG 30 of Ball et al, a set of register values (values registered by a utility meter) are read and recorded at step 3030. As illustrated in FIG 29, this action is performed by the register circuit 2910. Also see col. 16, lines 28-40. Accordingly, the register circuit corresponds to "*recording compliance means*" as set forth in claim 8 of US Patent 9,927,150. Additionally, FIG 29 teaches a wireless network 2975, which corresponds to "*wireless* communication" as recited in claim 8 of the '150 patent.

There is a substantial likelihood that a reasonable examiner would consider the Ball et al patent important in deciding whether or not the claim is patentable. The same question of patentability has not already been decided as to the claim in a final holding of invalidity by a federal court or by the Office in an earlier concluded examination or review of the '150 patent. The same question of patentability has not been raised to or by the Office in a pending reexamination or supplemental examination of the '150 patent.

Accordingly, Ball et al raises an SNQ with respect to claim 8. Since each of claims 9-19 and 28 incorporate the subject matter of claim 8 by reference, an SNQ is additionally raised by Ball et al for this set of dependent claims.

SNQ #6: Does Broniak et al raise an SNQ in view of claims 8-19 and 28?

FIG 1 of Broniak et al illustrates a "central controller 10" which is controllable via a laptop 38 or cellphone 38. Accordingly, the central controller 10" corresponds to a "*remotely controllable base station*" as set forth in claim 8 of the '150 patent. FIG 1 of Broniak et al illustrates a memory 30 with a table 32 to collect water consumption data, energy consumption data or generation data (col. 5, lines 60-62). The memory 30 with table 32 thus corresponds to a "*recording compliance means*" as set forth in claim 8 of US Patent 9,927,150. Additionally, FIG 1 teaches a wireless cell phone 38 that corresponds to the "*cell phone*" as recited in claim 8 of the '150 patent.

There is a substantial likelihood that a reasonable examiner would consider the Broniak et al patent important in deciding whether or not the claim is patentable. The same question of patentability has not already been decided as to the claim in a final holding of invalidity by a federal court or by the Office in an earlier concluded examination or review of the '150 patent. The same question of patentability has not been raised to or by the Office in a pending reexamination or supplemental examination of the '150 patent.

Accordingly, Broniak et al raises an SNQ with respect to claim 8. Since each of claims 9-19 and 28 incorporate the subject matter of claim 8 by reference, an SNQ is additionally raised by Broniak et al for this set of dependent claims.

SNQ #7: Does Blackwell et al ('421) raises an SNQ in view of claims 8-19 and 28?

FIG 1 of Blackwell ('421) illustrates a "utility meter RF transmitter 12" which is controllable via a web page accessed by a customer through a web server 11. Accordingly, the "utility meter RF transmitter 12" corresponds to a "*remotely controllable base station*" as set forth in claim 8 of the '150 patent. Referring to FIG 2 of Blackwell ('421), a data record is created with a time stamp 31, header 32, status 34 and a meter reading 35. Either the data record or the computer structure creating this data record corresponds to a "*recording compliance means*" as set forth in

claim 8 of US Patent 9,927,150. Additionally, FIG 1 teaches a wireless cell phone 28 that corresponds to the "*cell phone*" as recited in claim 8 of the '150 patent.

There is a substantial likelihood that a reasonable examiner would consider the Blackwell ('421) patent important in deciding whether or not the claim is patentable. The same question of patentability has not already been decided as to the claim in a final holding of invalidity by a federal court or by the Office in an earlier concluded examination or review of the '150 patent. The same question of patentability has not been raised to or by the Office in a pending reexamination or supplemental examination of the '150 patent.

Accordingly, Blackwell ('421) raises an SNQ with respect to claim 8. Since each of claims 9-19 and 28 incorporate the subject matter of claim 8 by reference, an SNQ is additionally raised by Blackwell ('4213) for this set of dependent claims.

SNQ #8: Does Palayur raise an SNQ in view of claims 8-19 and 28?

FIG 1 of Palayur illustrates a "base unit 1 " which is controllable via a laptop 10 or mobile communication device 11 via the Internet. Accordingly, the base unit 13" corresponds to a "*remotely controllable base station*" as set forth in claim 8 of the '150 patent. FIG 6 of Broniak et al illustrates a control logic that monitors water usage against daily and monthly quotas, as well as against a preset usage threshold. The processor which performs these steps or, or the control logic itself that perform these steps correspond to "*recording compliance means*" as set forth in claim 8 of US Patent 9,927,150.

There is a substantial likelihood that a reasonable examiner would consider the Palayur publication important in deciding whether or not the claim is patentable. The same question of patentability has not already been decided as to the claim in a final holding of invalidity by a federal court or by the Office in an earlier concluded examination or review of the '150 patent.

The same question of patentability has not been raised to or by the Office in a pending reexamination or supplemental examination of the '150 patent.

Accordingly, Palayur raises an SNQ with respect to claim 8. Since each of claims 9-19 and 28 incorporate the subject matter of claim 8 by reference, an SNQ is additionally raised by Palayur for this set of dependent claims.

Service of Papers

After filing of a request for ex parte reexamination by a third party requester, any document filed by either the patent owner or the third party requester must be served on the other party (or parties where two or more third party requester proceedings are merged) in the reexamination proceeding in the manner provided in 37 CFR 1.248. The document must reflect service or the document may be refused consideration by the Office. See 37 CFR 1.550(f).

Extensions of Time

Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that ex parte reexamination proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extensions of time in ex parte reexamination proceedings are provided for in 37 CFR 1.550(c).

Litigation Reminder

The patent owner is reminded of the continuing responsibility under 37 CFR 1.565(a) to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving the patent throughout the course of this reexamination proceeding. The third party requester is also reminded of the ability to similarly apprise the Office of any such activity or proceeding throughout the course of this reexamination proceeding. See MPEP §§ 2207, 2282 and 2286.

Conclusion

Claims 8-19 and 28 are requested for reexamination. Claims 8-19 and 28 will be subject to reexamination in this proceeding.

Correspondence

All correspondence relating to this *ex parte* reexamination proceeding should be directed as follows:

By **U.S. Postal Service Mail** to:

Mail Stop *Ex Parte* Reexam
ATTN: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand to: Customer Service Window
Randolph Building
401 Dulany St.
Alexandria, VA 22314

Any inquiry concerning this communication or earlier communications from the Reexamination Legal Advisor or Examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

/SAMUEL G RIMELL/
Primary Examiner, Art Unit 3992

Conferees:

/ANGELA M LIE/
Primary Examiner, Art Unit 3992

/ALEXANDER J KOSOWSKI/
Supervisory Patent Examiner, Art Unit 3992

Reexamination	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/014,354	99297150
	Certificate Date	Certificate Number

Requester Correspondence Address: ☑ Patent Owner ☐ Third Party
Michael E. Klicpera P.O. Box 573 La Jolla, CA 92038-0573

LITIGATION REVIEW ☑	/SR/ (examiner initials)	04 September 2019 (date)
Case Name		Director Initials
None		

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	NUMBER

U.S. Patent and Trademark Office DOC. CODE **RXFILJKT**

Search Notes	Application/Control No. 90/014,354	Applicant(s)/Patent Under Reexamination 99297150
	Examiner SAM RIMELL	Art Unit 3992

CPC - Searched*		
Symbol	**Date**	**Examiner**

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
Reviewed US Patent 9,297,150	09/04/2019	SR

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)
Approved for use through 11/30/2020. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13776963
	Filing Date	2013-02-26
	First Named Inventor	KLICPERA
	Art Unit	3753
	Examiner Name	JELLETT
	Attorney Docket Number	70947.01

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/S.G.R/	1	8833390	B2	2014-09-16	BALL	Fig. 1-2, 11, 23, 29, and 31, Col. 3, lines 17-67,Col. 4, lines 1-31, Col. 8, lines 20-32, Col. 111 lines 7-28, Col. 12, lines 23-42, Col. 16, lines 17-67, Col. 17, lines 1-44
/S.G.R/	2	9253754	B2	2016-02-02	SANDERFORD	Fig. 2 and 4, Col. 7, lines 2-67, Col. 9, lines 65-67, Col. 10, lines 1-43
/S.G.R/	3	6539968	B1	2003-04-01	WHITE	Fig. 4 and 6, Col. 2, lines 43-51, Col. 5, lines 35-50, Claim 1
/S.G.R/	4	5660198		1997-08-26	McCLARAN	Fig. 1, Col. lines 35-49, Col. 2, lines 15-25, 55-60, Col. 3, lines 10-40
/S.G.R/	5	5636653		1997-06-10	TITUS	Fig. 2 and 16, Col. 2, lines 35-67, Col. 3, lines 1-3, Col. 4, lines 38-67, Col. 5, lines 1-67, Col. 6, lines 1-53, Col. 12, lines 42-60
/S.G.R/	6	6105607	B2	2000-08-22	CAISE	Fig. 7, Col. 3, lines 33-67. Col. 5, lines 53-56
/S.G.R/	7	6543479	B2	2003-04-08	COFFEY	Fig. 2, 4, and 5, Col. 2, lines 14-67, Col. 3, lines 38-56
/S.G.R/	8	9019120	B2	2015-04-28	BRONIAK	Fig. 1, 2, and 3, Col. 3, lines 1-19, 52-67, Col. 4, lines 1-37, 56-63, Col. 5 lines 1-67

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/S.G.R/	9	4949976		1990-07-10	GASTOUNIOTIS	Fig. 1, Col. 3 lines 7-67, Col. 3 lines 40-65
/S.G.R/	10	5298894		1994-03-29	CERNY	Fig. 2, 3, and 5, Col. 3 lines 6-52
/S.G.R/	11	8539827	B2	2012-08-02	BENSON	Fig. 1, Col. 1 lines 45-48, Col.2 lines 47-57, 61-64, Col. 3 lines 3-4, 17-30, 64-67
/S.G.R/	12	8644804	B2	2011-04-07	BLACKWELL	Col. 1 lines 7-10, 53-55, Col. 2 lines 31-33, 51-85. Col. 2 lines 63-76, Col. 3 lines 1-11
/S.G.R/	13	8878690	B2	2010-12-23	OLSON	Fig. 2,3, 4, and 5, Col. lines 61-62, Col. 4 lines 3-8, 43-60, Col. 3, lines 22-25
/S.G.R/	14	7012546	B2	2002-07-02	ZIGDON	Col. 5 lines 33-43, Col. 7 lines 12-19, 36-40, Col. 8, lines 35-38, Col. 10 lines 14-18
/S.G.R/	15	8269651	B2	2006-11-02	ZIGDON	Col. 4 lines 46-58, Col. 5, lines 39-43, Col. 7 lines 2-6, 24-29, 36-40, Col. 8 lines 25-28,Col. 9 lines 66-67, Col. 10 lines 1-3, Col. 16 lines 47-4
/S.G.R/	16	7626511	B2	2007-12-13	LAZAR	Col. 1 lines 104, Col. 3 lines 2-6, 21-26, 37-42, 54,60
/S.G.R/	17	7605717	B2	2009-10-20	OLSON	Col. 2, lines 38-60, Col. lines 1-50, Col. 3 lines 1-14
/S.G.R/	18	8217804	B2	2012-07-10	LAUGHLIN-PARKER	Col. 1, lines 14-60, Col. 3 lines 24-67
/S.G.R/	19	8625722	B2	2014-01-07	ROUQUETTE	Col. 3 lines 5-50, Col. 6, lines 41-50, Col. 7 lines 17-47, Col. 8 lines 59-67, Col. 14, lines 32-43

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/S.G.R/	20	8602384	B2	2013-12-10	WILLIAMSON	Fig. 1, Col. 2, lines 44-57
/S.G.R/	21	5971011		1999-10-26	PRICE	Abstract, Col. 2, line 7-67, Col. 4, lines 7-28

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/S.G.R/	1	20040193329	A1	2004-09-30	RANSOM	Paragraphs 107, 110, 116, 118-123, 124-125, 127, 129, 133, 143, 144-145, 150, 162, 163-164, 166-167, 168, 173-174, 194.
/S.G.R/	2	20080149180	A1	2008-08-26	PARRIS	Fig. 1, 7, 8,15 and 16, Paragraphs 96, 99, 109, 117, 121, 123, 141, 151, 156, 159-163, 171-173, 205, 212 220-221
/S.G.R/	3	20080295895	A1	2008-12-04	VINCENT	Paragraphs 1, 10, 11, 13, 14
/S.G.R/	4	20110035063	A1	2011-02-10	PALAYUR	Fig. 1-10, 14, 16-17, Paragraphs 8, 15, 16, 22-25, 36, 40, 69, 75, 80, 84, 91

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13776963
	Filing Date	2013-02-26
	First Named Inventor	KLICPERA
	Art Unit	3753
	Examiner Name	JELLETT
	Attorney Docket Number	70947.01

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1		☐

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EXAMINER SIGNATURE

Examiner Signature	/SAMUEL G RIMELL/	Date Considered	09/02/2019

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Application Number	13776963
	Filing Date	2013-02-26
	First Named Inventor	KLICPERA
	Art Unit	3753
	Examiner Name	JELLETT
	Attorney Docket Number	70947.01

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael Edward Klicpera	Date (YYYY-MM-DD)	2019-08-02
Name/Print	Michael Edward Klicpera	Registration Number	38044

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

UNITED STATES PATENT AND TRADEMARK OFFICE

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www.uspto.gov

REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/014,354	08/02/2019	9297150

CONFIRMATION NO. 1805

REEXAM ASSIGNMENT NOTICE

22509
MICHAEL E. KLICPERA
PO BOX 573
LA JOLLA, CA 92038-0573

OC000000110421868

Date Mailed: 08/15/2019

NOTICE OF ASSIGNMENT OF REEXAMINATION REQUEST

The above-identified request for reexamination has been assigned to Art Unit 3993. All future correspondence to the proceeding should be identified by the control number listed above and directed to the assigned Art Unit.

A copy of this Notice is being sent to the latest attorney or agent of record in the patent file or to all owners of record. (See 37 CFR 1.33(c)). If the addressee is not, or does not represent, the current owner, he or she is required to forward all communications regarding this proceeding to the current owner(s). An attorney or agent receiving this communication who does not represent the current owner(s) may wish to seek to withdraw pursuant to 37 CFR 1.36 in order to avoid receiving future communications. If the address of the current owner(s) is unknown, this communication should be returned within the request to withdraw pursuant to Section 1.36.

NOTICE OF USPTO EX PARTE REEXAMINATION PATENT OWNER STATEMENT WAIVER PROGRAM

The USPTO has implemented a pilot program where, after a reexamination proceeding has been granted a filing date and before the examiner begins his or her review, the patent owner may orally waive the right to file a patent owner's statement. See *"Pilot Program for Waiver of Patent Owner's Statement in Ex Parte Reexamination Proceedings,"* 75 FR 47269 (August 5, 2010). One goal of the pilot program is to reduce the pendency of reexamination proceedings and improve the efficiency of the reexamination process.

Ordinarily when ex parte reexamination is ordered, the USPTO must wait until after the receipt of the patent owner's statement and the third party requester's reply, or after the expiration of the time period for filing the statement and reply (a period that can be as long as 5 to 6 months), before mailing a first determination of patentability. The USPTO's first determination of patentability is usually a first Office action on the merits or a Notice of Intent to Issue Reexamination Certificate (NIRC).

Under the pilot program, the patent owner's oral waiver allows the USPTO to act on the first determination of patentability immediately after determining that reexamination will be ordered, and in a suitable case issue the reexamination order and the first determination of patentability (which could be a NIRC if the claims under reexamination are confirmed) at the same time.

Benefits to the Patent Owner for participating in this pilot program include reduction in pendency.

To participate in this pilot program, Patent Owners may contact the USPTO's Central Reexamination Unit (CRU) at 571-272-7705. The USPTO will make the oral waiver of record in the reexamination file in an interview summary and a copy will be mailed to the patent owner and any third party requester.

cc: Third Party Requester(if any)

,

/tplovelace/

Legal Instruments Examiner
Central Reexamination Unit 571-272-7705; FAX No. 571-273-9900

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/014,354	08/02/2019	9297150

CONFIRMATION NO. 1805

22509
MICHAEL E. KLICPERA
PO BOX 573
LA JOLLA, CA 92038-0573

REEXAMINATION REQUEST NOTICE

OC000000110421866

Date Mailed: 08/15/2019

NOTICE OF REEXAMINATION REQUEST FILING DATE

(Patent Owner Requester)

Requester is hereby notified that the filing date of the request for reexamination is 08/02/2019, the date the required fee was received. (See CFR 1.510(d)).

A decision on the request for reexamination will be mailed within three months from the filing date of the request for reexamination. (See 37 CFR 1.515(a)).

Pursuant to 37 CFR 1.33(c), future correspondence in this reexamination proceeding will be with the latest attorney or agent of the record in the patent file.

The paragraphs checked below are part of this communication:

___ 1. The party receiving the courtesy copy is the latest attorney or agent of record in the patent file.

___ 2. The person named to receive the correspondence in this proceeding has not been made the latest attorney or agent of record in the patent file because:

___ A. Requester's claim of ownership of the patent is not verified by the record.

___ B. The request papers are not signed with a real or apparent binding signature.

___ C. The mere naming of a correspondence addressee does not result in that person being appointed as the latest attorney or agent of record in the patent file.

___ 3. Addressee is the latest attorney or agent of record in the patent file.

___ 4. Other ____

/tplovelace/

Legal Instruments Examiner
Central Reexamination Unit 571-272-7705; FAX No. 571-273-9900

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BIB DATA SHEET

CONFIRMATION NO. 1805

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
90/014,354	08/02/2019 **RULE**	251	3993	70947.01

APPLICANTS

INVENTORS
99297150, Residence Not Provided;
REIN TECH, INC. (ASSIGNEE), CHEYENNE, WY;
PATENT OWNER, Residence Not Provided;

**** CONTINUING DATA ***************************
This application is a REX of 13/776,963 02/26/2013 PAT 9297150 *
which claims benefit of 61/729,653 11/26/2012
and is a CIP of 13/541,819 07/05/2012 ABN
which is a CIP of 13/216,521 08/24/2011 PAT 8347427
and is a CIP of 13/216,497 08/24/2011 PAT 8887324
which is a CIP of 12/986,341 01/08/2011 ABN
which is a CIP of 12/877,094 09/07/2010 PAT 9266136
which is a CIP of 12/539,150 08/11/2009 PAT 9061307
and is a DIV of 11/877,860 10/24/2007 PAT 9254499
(*)Data provided by applicant is not consistent with PTO records.

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** MICRO ENTITY **

Foreign Priority / Verification	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☐ Yes ☐ No 35 USC 119(a-d) conditions met ☐ Yes ☐ No Verified and Acknowledged ______ Examiner's Signature	☐ Met after Allowance ______ Initials			28	4

ADDRESS

MICHAEL E. KLICPERA
PO BOX 573
LA JOLLA, CA 92038-0573
UNITED STATES

TITLE

WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM

FILING FEE RECEIVED		
FILING FEE RECEIVED 3000	FEES: Authority has been given in Paper No.____________ to charge/credit DEPOSIT ACCOUNT No.____________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other ____________ ☐ Credit

BIB (Rev. 05/07).

Patent Assignment Abstract of Title

Total Assignments: 1

Application #: 13776963 **Filing Dt:** 02/26/2013 **Patent #:** 9297150 **Issue Dt:** 03/29/2016
PCT #: NONE **Intl Reg #:** **Publication #:** US20140238511 **Pub Dt:** 08/28/2014
Inventor: Michael Edward Klicpera
Title: WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM

Assignment: 1

Reel/Frame: 047325 / 0670 **Received:** 10/26/2018 **Recorded:** 10/26/2018 **Mailed:** 10/29/2018 **Pages:** 7
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
Assignor: KLICPERA, MICHAEL **Exec Dt:** 08/20/2018
Assignee: REIN TECH, INC.
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CHEYENNE, WYOMING 82001
Correspondent: PETER CORCORAN, CORCORAN IP LAW PLLC
2019 RICHMOND ROAD SUITE 380
TEXARKANA, TX 75503

Search Results as of: 08/08/2019 05:05 PM

If you have any comments or questions concerning the data displayed, contact PRD / Assignments at 571-272-3350. v.2.6
Web interface last modified: Jun 26, 2017 v.2.6

Litigation Search Report CRU 3999

Reexam Control No. 90/014354

To: Examiner Location: CRU Art Unit: 3999 Date: 08/06/2019	From: KAREN L. WARD Location: CRU 3999 REM 4C84 Phone: (571) 272-7932 KAREN.WARD@uspto.gov

Search Notes

Litigation was found for US Patent Number: 9,297,150.

1:18cv1682, Rein Tech, Inc. V. Flo Technologies, Inc.
Delaware District Court Oct. 26, 2018 1:18cv1682 Patent Patent Infringement Closed

1:18cv1683, Rein Tech. Inc. V. Mueller Systems, Llc
Delaware District Court Oct. 26, 2018 1:18cv1683 Patent Patent Infringement Open

1:18cv1684, Rein Tech. Inc. V. Xylem, Inc.
Delaware District Court Oct. 26, 2018 1:18cv1684 Patent Patent Infringement Closed

1) I performed a KeyCite Search in Westlaw, which retrieves all history on the patent including any litigation.

2) I performed a search on the patent in Lexis CourtLink for any open dockets or closed cases.

3) I performed a search in Lexis in the Federal Courts and Administrative Materials databases for any cases found.

4) I performed a search in Lexis in the IP Journal and Periodicals database for any articles on the patent.

5) I performed a search in Lexis in the news databases for any articles about the patent or any articles about litigation on this patent.

Citing References (20)

Treatment	Title	Date	Type	Depth	Headnote(s)
Cited by	**1. Water use monitoring apparatus** LitAlert P2018-44-05 ... 1:18CV01682 Filing Date: 10/26/2018 Subsequent Action: 10/26/2018 Action Taken: CAUSE - 35 USC 271 - COMPLAINT FOR PATENT INFRINGEMENT Notes: none Other Patents: US 9297150 US 9494480 US 9749792 Other Trademarks: none See LitAlert No: none ...	Oct. 26, 2018	Lit Alert	▯▯	—
Cited by	**2. Water use monitoring apparatus** LitAlert P2018-44-06 ... 1:18CV01683 Filing Date: 10/26/2018 Subsequent Action: 10/26/2018 Action Taken: CAUSE - 35 USC 271 - COMPLAINT FOR PATENT INFRINGEMENT Notes: none Other Patents: US 9297150 US 9749792 Other Trademarks: none See LitAlert No: none ...	Oct. 26, 2018	Lit Alert	▯▯	—
Cited by	**3. Water use monitoring apparatus** LitAlert P2018-44-07 ... 1:18CV01684 Filing Date: 10/26/2018 Subsequent Action: 10/26/2018 Action Taken: CAUSE - 35 USC 271 - COMPLAINT FOR PATENT INFRINGEMENT Notes: none Other Patents: US 9297150 US 9494480 US 9749792 Other Trademarks: none See LitAlert No: none ...	Oct. 26, 2018	Lit Alert	▯▯	—
—	**4. APPARATUS FOR PERFORMING WATER USE/WATER ENERGY USE MONITOR AND/OR LEAK DETECTION IN BUILDING/STRUCTURE FOR E.G. RESIDENTIAL HOME, HAS CELL PHONE FOR WIRELESSLY RECEIVING WATER DATA, WATER ENERGY UTILIZATION DATA AND WATER QUALITY DATA** Out Of Plan DWPI 2016-34830K ... 016178 2016-02-04 Application priority US 776963 2013-02-26 Application priority Earliest Priority Date:2013-02-26 Related:Continuation of US patent number US 9297150 B No. of Countries:1 No. of Patents:1 First Derwent Appearance:2016.40 Latest Derwent Appearance:2016.40 Classification Information International Classes (IPC ...	Feb. 26, 2013	DWPI	—	—

List of 20 Citing References for WATER USE MONITORING APPARAT...

Treatment	Title	Date	Type	Depth	Headnote(s)
—	**5. WATER PARAMETER UTILIZING AND MONITORING APPARATUS FOR BEING INTEGRATED WITH E.G. COLD WATER SUPPLY LINE, FOR MONITORING OF WATER ENERGY IN E.G. BUILDING, HAS APPARATUSES STORED WITH INSTRUCTIONS TO EXHIBIT INFORMATION ON DISPLAY UNIT** Out Of Plan DWPI 2015-41895H ... 11 Application priority Earliest Priority Date:2009-08-11 Related:Continuation In Part of US patent US 9061307 B Continuation In Part of US patent US 9297150 B No. of Countries:1 No. of Patents:2 First Derwent Appearance:2015.49 Latest Derwent Appearance:2016.76 Classification Information International Classes (IPC ...	Aug. 11, 2009	DWPI	—	—
—	**6. WATER PARAMETER USE AND MONITORING APPARATUS, HAS BASE STATION FUNCTIONS AS MESH-ENABLED DEVICE AND COMBINATION FUNCTION AS SIGNAL REPEATERS FOR RELAYING DATA TO ACCESS POINT USING ENCRYPTION AND IDENTIFICATION TECHNOLOGY** Out Of Plan DWPI 2016-169164 ... 11 Application priority Earliest Priority Date:2009-08-11 Related:Continuation In Part of US patent US 9061307 B Continuation In Part of US patent US 9297150 B Continuation In Part of US patent US 9494480 B No. of Countries:1 No. of Patents:2 First Derwent Appearance:2016.21 Latest ...	Aug. 11, 2009	DWPI	—	—
—	**7. WATER DAMAGE PREVENTION SYSTEM FOR E.G. RESIDENTIAL HOME, HAS KEY CHAIN APPARATUS TO SEND WIRELESS SIGNAL TO BASE STATION TO TURN ON/OFF A WATER SUPPLY LINE, AND INDICATING UNIT TO DETERMINE OPERATIONAL STATE OF SHUT-OFF/ON MECHANISM** Out Of Plan DWPI 2014-Q16988 ... apparatus having an indicating means for determining the operational state of the remotely shut-off/on mechanism.First Derwent Appearance:2014.58 Publication No. (Derwent): US 9297150 B2 Original Title (English):WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM Publication Date:2016-03-29 Application No.:US 776963 Application Date ...	Oct. 04, 2007	DWPI	—	—
—	**8. RF 047325/0670** Out Of Plan ... 2011-12-15 Application Number 13/216521 Application Date 2011-08-24 Title WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM Granted Patent Number US Pat. 9297150 Granted Patent Date 2016-03-29 Published Application Number US Pat. App. 20140238511 Published Application Date 2014-08-28 Application Number 13/776963 ...	Oct. 26, 2018	Assignments	—	—

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Treatment	Title	Date	Type	Depth	Headnote(s)
—	**9. PatStat 9297150** ... Patent Status File Patent Number: US 9297150 Change Code: COR Description: Certificate of Correction Reissue Number:OG Date: 05/15/2018 ...	May 15, 2018	Patent Status Files	—	—
—	**10. Rein Tech, Inc. v. Flo Technologies, Inc.**	Oct. 26, 2018	Docket Summaries	—	—
—	**11. Rein Tech, Inc. v. Mueller Water Products, Inc.**	Oct. 26, 2018	Docket Summaries	—	—
—	**12. Rein Tech, Inc. v. Xylem, Inc.**	Oct. 26, 2018	Docket Summaries	—	—
—	**13. SYSTEMS AND METHODS FOR MANAGING SMART DEVICES BASED UPON ELECTRICAL USAGE DATA** (Out Of Plan) US PAT 10353359 , U.S. PTO Utility Systems and methods for managing the operation of devices within a home or other property based upon electrical usage data. With customer knowledge or consent, a home controller... ... US 8798289 2014/08 Every 381/094.1 US US 9049168 2015/06 Jacob et al.US US 9280252 2016/03 Brandmaier et al.US US 9297150 2016/03 Klicpera US US 9424606 2016/08 Wilson, II et al.US US 9429925 2016/08 Wait US US 9652976 2017/05 Bruck ...	July 16, 2019	Patents	—	—
—	**14. SYSTEMS AND METHODS FOR RESPONDING TO A BROKEN CIRCUIT** (Out Of Plan) US PAT 10346811 , U.S. PTO Utility Risk of damage that is caused by the breaking of a circuit may be mitigated. A smart home controller and/or insurance provider remote processor may analyze data, with an insured's... ... US US 8749381 2014/06 Maroney et al.US US 9049168 2015/06 Jacob et al.US US 9280252 2016/03 Brandmaier et al.US US 9297150 2016/03 Klicpera US US 9424606 2016/08 Wilson, II et al.US US 9429925 2016/08 Wait US US 9652976 2017/05 Bruck ...	July 09, 2019	Patents	—	—
—	**15. SYSTEMS AND METHODS FOR DETERMINING CAUSE OF LOSS TO A PROPERTY** (Out Of Plan) US PAT 10282787 , U.S. PTO Utility Methods and systems for assessing damage to a property associated with an insurance-related event are provided. According to certain aspects, a smart home controller or insurance... ... US US 8749381 2014/06 Maroney et al.US US 9049168 2015/06 Jacob et al.US US 9280252 2016/03 Brandmaier et al.US US 9297150 2016/03 Klicpera US US 9424606 2016/08 Wilson, II et al.US US 9429925 2016/08 Wait US US 9652976 2017/05 Bruck ...	May 07, 2019	Patents	—	—

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List of 20 Citing References for WATER USE MONITORING APPARAT...

Treatment	Title	Date	Type	Depth	Headnote(s)
—	**16. SYSTEMS AND METHODS FOR MANAGING SERVICE LOG INFORMATION** Out Of Plan US PAT 10282788 , U.S. PTO Utility Methods and systems for processing insurance policies associated with properties may be provided. A home may be populated with smart devices that are connected to, or in... ... US US 8749381 2014/06 Maroney et al.US US 9049168 2015/06 Jacob et al.US US 9280252 2016/03 Brandmaier et al.US US 9297150 2016/03 Klicpera US US 9424606 2016/08 Wilson, II et al.US US 9429925 2016/08 Wait US US 9652976 2017/05 Bruck ...	May 07, 2019	Patents	—	—
—	**17. SYSTEMS AND METHODS FOR AUTOMATICALLY GENERATING AN ESCAPE ROUTE** Out Of Plan US PAT 10282961 , U.S. PTO Utility Methods and systems for generating escape routes are provided. With a home owner's or insured's permission, a smart home controller or insurance provider remote processor may... ... US US 8749381 2014/06 Maroney et al.US US 9049168 2015/06 Jacob et al.US US 9280252 2016/03 Brandmaier et al.US US 9297150 2016/03 Klicpera US US 9424606 2016/08 Wilson, II et al.US US 9429925 2016/08 Wait US US 9652976 2017/05 Bruck ...	May 07, 2019	Patents	—	—
—	**18. SYSTEMS AND METHODS FOR SYSTEMIC RESOURCE UTILIZATION ANALYSIS AND MANAGEMENT** Out Of Plan US PAT 10282966 , U.S. PTO Utility Systems, methods, and articles of manufacture provide for systemic resource utilization analysis and management, such as employing a single-point sensor to detect or identify... ... Klicpera US US 8922379 2014/12 Meyer 340/521 US US 8976795 2015/03 Kuehnel 370/395.3 US US 9178632 2015/11 Grob US US 9297150 2016/03 Klicpera US US 9351124 2016/05 Shelton US US 9360874 2016/06 Imes US US 9383289 2016/07 Meyer US US 9494480 ...	May 07, 2019	Patents	—	—
—	**19. SYSTEMS AND METHODS FOR AUTOMATICALLY RESPONDING TO A FIRE** Out Of Plan US PAT 10249158 , U.S. PTO Utility Methods and systems for generating a response to detecting a fire on a property are provided. In certain aspects, a smart home controller (or other smart controller) may analyze... ... et al.US US 9049168 2015/06 Jacob et al.US US 9257023 2016/02 Lee US US 9280252 2016/03 Brandmaier et al.US US 9297150 2016/03 Klicpera US US 9424606 2016/08 Wilson, II et al.US US 9429925 2016/08 Wait US US 9652976 2017/05 Bruck ...	Apr. 02, 2019	Patents	—	—

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Treatment	Title	Date	Type	Depth	Headnote(s)
—	**20. SYSTEMS AND METHODS FOR ASSIGNING DAMAGE CAUSED BY AN INSURANCE-RELATED EVENT** Out Of Plan US PAT 10181160 , U.S. PTO Utility Methods and systems for assigning damage to a property to causes of loss are provided. A smart home controller and/or an insurance provider remote processor (or server) may... ... US US 8749381 2014/06 Maroney 340/540 US US 9049168 2015/06 Jacob 709/206 US US 9280252 2016/03 Brandmaier et al.US US 9297150 2016/03 Klicpera US US 9424606 2016/08 Wilson, II US US 9429925 2016/08 Wait US US 9652976 2017/05 Bruck US US ...	Jan. 15, 2019	Patents	—	—

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Date and Time: Tuesday, August 6, 2019 10:33:00 AM EDT

Job Number: 94393492

Documents (3)

1. *1:18cv1682, Rein Tech, Inc. V. Flo Technologies, Inc.*

   Client/Matter: -None-

   Search Terms: US PAT 9297150

   Search Type: Natural Language

   Narrowed by:

Content Type	Narrowed by
Dockets	Case Status: Open,Unknown,Closed

2. *1:18cv1683, Rein Tech, Inc. V. Mueller Systems, Llc*

   Client/Matter: -None-

   Search Terms: US PAT 9297150

   Search Type: Natural Language

   Narrowed by:

Content Type	Narrowed by
Dockets	Case Status: Open,Unknown,Closed

3. *1:18cv1684, Rein Tech, Inc. V. Xylem, Inc.*

   Client/Matter: -None-

   Search Terms: US PAT 9297150

   Search Type: Natural Language

   Narrowed by:

Content Type	Narrowed by
Dockets	Case Status: Open,Unknown,Closed

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1:18cv1682, Rein Tech, Inc. V. Flo Technologies, Inc.

US District Court Docket

US District Court for the District of Delaware

(Wilmington)

This case was retrieved on 08/05/2019

Header

Case Number: 1:18cv1682
Date Filed: 10/26/2018
Assigned To: Judge Maryellen Noreika
Nature of Suit: Patent (830)
Cause: Patent Infringement
Lead Docket: None
Other Docket: 1:18cv01683, 1:18cv01684
Jurisdiction: Federal Question

Class Code: Closed
Closed: 01/02/2019
Statute: 35:271
Jury Demand: Plaintiff
Demand Amount: $0
NOS Description: Patent

Litigants

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Proceedings

#	Date	Proceeding Text	Source
1	10/26/2018	COMPLAINT FOR PATENT INFRINGEMENT filed with Jury Demand against Flo Technologies, Inc. - Magistrate Consent Notice to Pltf. (Filing fee $ 400, receipt number 0311-2490482.) -	

SHANETTE BROWN

1:18cv1682, Rein Tech, Inc. V. Flo Technologies, Inc.

#	Date	Proceeding Text	Source
		filed by Rein Tech, Inc. (Attachments: # 1 Exhibits 1-5, # 2 Exhibits 6-14, # 3 Exhibits 15-18, # 4 Civil Cover Sheet)(ceg) (Entered: 10/26/2018)	
2	10/26/2018	Notice, Consent and Referral forms re: U.S. Magistrate Judge jurisdiction. (ceg) (Entered: 10/26/2018)	
3	10/26/2018	Report to the Commissioner of Patents and Trademarks for Patent/Trademark Number(s) US 8,347,427 B2; US 9,297,150 B2; US 9,749,792 B2; US 9,494,480 B2. (ceg) (Entered: 10/26/2018)	
	10/26/2018	Summons Issued with Magistrate Consent Notice attached as to Flo Technologies, Inc. on 10/26/2018. Requesting party or attorney should pick up issued summons at the Help Desk, Room 4209, or call 302-573-6170 and ask the Clerk to mail the summons to them. (ceg) (Entered: 10/26/2018)	
4	10/26/2018	Disclosure Statement pursuant to Rule 7.1: No Parents or Affiliates Listed filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 10/26/2018)	
5	10/30/2018	SUMMONS Returned Executed by Rein Tech, Inc.. Flo Technologies, Inc. served on 10/29/2018, answer due 11/19/2018. (Devlin, Timothy) (Entered: 10/30/2018)	
6	10/30/2018	MOTION for Pro Hac Vice Appearance of Attorney Peter J. Corcoran, III - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 10/30/2018)	
	10/31/2018	Case Assigned to Judge Maryellen Noreika. Please include the initials of the Judge (MN) after the case number on all documents filed. Associated Cases: 1:18-cv-01682-MN, 1:18-cv-01683-MN, 1:18-cv-01684-MN (rjb) (Entered: 10/31/2018)	
	11/01/2018	SO ORDERED re 6 MOTION for Pro Hac Vice Appearance of Attorney Peter J. Corcoran, III filed by Rein Tech, Inc. ORDERED by Judge Maryellen Noreika on 11/1/2018. (dlw) (Entered: 11/01/2018)	
	11/02/2018	Pro Hac Vice Attorney Peter J. Corcoran for Rein Tech, Inc. added for electronic noticing. Pursuant to Local Rule 83.5 (d)., Delaware counsel shall be the registered users of CM/ECF and shall be required to file all papers. (lak) (Entered: 11/02/2018)	
7	11/19/2018	STIPULATION TO EXTEND TIME to Answer the Complaint to December 20, 2018 - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 11/19/2018)	
	11/19/2018	SO ORDERED re 7 STIPULATION TO EXTEND TIME to Answer the Complaint to December 20, 2018 (Set/Reset Answer Deadlines: Flo Technologies, Inc. answer due 12/20/2018). ORDERED by Judge Maryellen Noreika on 11/19/2018. (dlw) (Entered: 11/19/2018)	
8	12/19/2018	STIPULATION TO EXTEND TIME Answer Complaint to January 10, 2019 - filed by Flo Technologies, Inc.. (Joyce, Elizabeth) (Entered: 12/19/2018)	
	12/19/2018	SO ORDERED re 8 STIPULATION TO EXTEND TIME Answer Complaint to January 10, 2019 (Set/Reset Answer Deadlines: Flo Technologies, Inc. answer due 1/10/2019). ORDERED by Judge Maryellen Noreika on 12/19/2018. (dlw) (Entered: 12/19/2018)	
9	12/28/2018	STIPULATION of Dismissal With Prejudice by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 12/28/2018)	
10	01/02/2019	SO ORDERED re 9 Stipulation of Dismissal. ***Civil Case Terminated. Signed by Judge Maryellen Noreika on 1/2/2019. (dlw) (Entered: 01/02/2019)	
11	01/02/2019	Report to the Commissioner of Patents and Trademarks for Patent/Trademark Number(s). (Attachments: # 1 Stipulation of Dismissal)(mdb) (Entered: 01/02/2019)	

SHANETTE BROWN

1:18cv1682, Rein Tech, Inc. V. Flo Technologies, Inc.

Patents

Number	Title	Issued	Class	Subclass
8,347,427	Water use monitoring apparatus	01/08/2013	4	643
9,297,150	Water use monitoring apparatus and water damage prevention system	03/29/2016	1	1
9,494,480	Water use monitoring apparatus	11/15/2016	1	1
9,749,792	Water use monitoring apparatus	08/29/2017	1	1

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End of Document

SHANETTE BROWN

1:18cv1683, Rein Tech, Inc. V. Mueller Systems, Llc

US District Court Docket

US District Court for the District of Delaware

(Wilmington)

This case was retrieved on 08/05/2019

Header

Case Number: 1:18cv1683
Date Filed: 10/26/2018
Assigned To: Judge Maryellen Noreika
Nature of Suit: Patent (830)
Cause: Patent Infringement
Lead Docket: None
Other Docket: 1:18cv01682, 1:18cv01684
Jurisdiction: Federal Question

Class Code: Open
Statute: 35:271
Jury Demand: Plaintiff
Demand Amount: $0
NOS Description: Patent

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1:18cv1683, Rein Tech, Inc. V. Mueller Systems, Llc

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Proceedings

#	Date	Proceeding Text	Source
1	10/26/2018	COMPLAINT FOR PATENT INFRINGEMENT filed with Jury Demand against Mueller Water Products, Inc. - Magistrate Consent Notice to Pltf. (Filing fee $ 400, receipt number 0311-2490489.) - filed by Rein Tech, Inc. (Attachments: # 1 Exhibits 1-3, # 2 Exhibits 4-7, # 3 Exhibits 8-10, # 4 Civil Cover Sheet)(ceg) (Entered: 10/26/2018)	
2	10/26/2018	Notice, Consent and Referral forms re: U.S. Magistrate Judge jurisdiction. (ceg) (Entered: 10/26/2018)	
3	10/26/2018	Report to the Commissioner of Patents and Trademarks for Patent/Trademark Number(s) US 8,347,427 B2; US 9,297,150 B2; US 9,749,792 B2. (ceg) (Entered: 10/26/2018)	
	10/26/2018	Summons Issued with Magistrate Consent Notice attached as to Mueller Water Products, Inc. on 10/26/2018. Requesting party or attorney should pick up issued summons at the Help Desk, Room 4209, or call 302-573-6170 and ask the Clerk to mail the summons to them. (ceg) (Entered: 10/26/2018)	
4	10/26/2018	Disclosure Statement pursuant to Rule 7.1: No Parents or Affiliates Listed filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 10/26/2018)	
5	10/30/2018	SUMMONS Returned Executed by Rein Tech, Inc.. Mueller Water Products, Inc. served on 10/29/2018, answer due 11/19/2018. (Devlin, Timothy) (Entered: 10/30/2018)	
6	10/30/2018	MOTION for Pro Hac Vice Appearance of Attorney Peter J. Corcoran, III - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 10/30/2018)	
	10/31/2018	Case Assigned to Judge Maryellen Noreika. Please include the initials of the Judge (MN) after the case number on all documents	

1:18cv1683, Rein Tech, Inc. V. Mueller Systems, Llc

#	Date	Proceeding Text	Source
		filed. Associated Cases: 1:18-cv-01682-MN, 1:18-cv-01683-MN, 1:18-cv-01684-MN (rjb) (Entered: 10/31/2018)	
	11/01/2018	SO ORDERED re 6 MOTION for Pro Hac Vice Appearance of Attorney Peter J. Corcoran, III filed by Rein Tech, Inc. ORDERED by Judge Maryellen Noreika on 11/1/2018. (dlw) (Entered: 11/01/2018)	
	11/02/2018	Pro Hac Vice Attorney Peter J. Corcoran for Rein Tech, Inc. added for electronic noticing. Pursuant to Local Rule 83.5 (d)., Delaware counsel shall be the registered users of CM/ECF and shall be required to file all papers. (lak) (Entered: 11/02/2018)	
7	11/05/2018	STIPULATION TO EXTEND TIME to Answer the Complaint to January 10, 2019 - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 11/05/2018)	
	11/05/2018	SO ORDERED re 7 STIPULATION TO EXTEND TIME to Answer the Complaint to January 10, 2019 (Set/Reset Answer Deadlines: Mueller Water Products, Inc. answer due 1/10/2019). ORDERED by Judge Maryellen Noreika on 11/5/2018. (dlw) (Entered: 11/05/2018)	
8	01/07/2019	STIPULATION TO EXTEND TIME to Answer the Complaint to January 24, 2019 - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 01/07/2019)	
	01/07/2019	SO ORDERED re 8 STIPULATION TO EXTEND TIME to Answer the Complaint to January 24, 2019 (Set/Reset Answer Deadlines: Mueller Water Products, Inc. answer due 1/24/2019). ORDERED by Judge Maryellen Noreika on 1/7/2019. (dlw) (Entered: 01/07/2019)	
9	01/08/2019	MOTION for Pro Hac Vice Appearance of Attorney Todd E. Jones, Attorney Coby S. Nixon and Attorney Seth Kincaid Trimble - filed by Mueller Water Products, Inc.. (Dorsney, Kenneth) (Entered: 01/08/2019)	
	01/08/2019	SO ORDERED re 9 MOTION for Pro Hac Vice Appearance of Attorney Todd E. Jones, Attorney Coby S. Nixon and Attorney Seth Kincaid Trimble filed by Mueller Water Products, Inc. ORDERED by Judge Maryellen Noreika on 1/8/2019. (dlw) (Entered: 01/08/2019)	
	01/15/2019	Pro Hac Vice Attorney Todd E. Jones for Mueller Water Products, Inc. added for electronic noticing. Pursuant to Local Rule 83.5 (d)., Delaware counsel shall be the registered users of CM/ECF and shall be required to file all papers. (ceg) (Entered: 01/15/2019)	
	01/15/2019	Pro Hac Vice Attorney Coby S. Nixon and Seth K. Trimble for Mueller Water Products, Inc. added for electronic noticing. Pursuant to Local Rule 83.5 (d)., Delaware counsel shall be the registered users of CM/ECF and shall be required to file all papers. (ceg) (Entered: 01/15/2019)	
10	01/24/2019	ANSWER to 1 Complaint, with Jury Demand , COUNTERCLAIM against Rein Tech, Inc. by Mueller Water Products, Inc..(Dorsney, Kenneth) (Entered: 01/24/2019)	
11	01/24/2019	Disclosure Statement pursuant to Rule 7.1: No Parents or Affiliates Listed filed by Mueller Water Products, Inc.. (Dorsney, Kenneth) (Entered: 01/24/2019)	
12	02/08/2019	STIPULATION TO EXTEND TIME to Answer Complaint to February 14, 2019 - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 02/08/2019)	
	02/08/2019	ORAL ORDER re 12 STIPULATION TO EXTEND TIME to Answer Counterclaims. IT IS HEREBY ORDERED that the Stipulation is DENIED as MOOT. The Court refers counsel to Rule 12(a)(1)(B) of the Federal Rules of Civil Procedure. ORDERED by Judge Maryellen Noreika on 2/8/2019. (dlw) (Entered: 02/08/2019)	

SHANETTE BROWN

1:18cv1683, Rein Tech, Inc. V. Mueller Systems, Llc

#	Date	Proceeding Text	Source
13	02/14/2019	STIPULATION TO EXTEND TIME to Answer Counterclaims to February 21, 2019 - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 02/14/2019)	
	02/15/2019	SO ORDERED re 13 STIPULATION TO EXTEND TIME to Answer Counterclaims to February 21, 2019 (Set/Reset Answer Deadlines: Rein Tech, Inc. answer due 2/21/2019). ORDERED by Judge Maryellen Noreika on 2/15/2019. (dlw) (Entered: 02/15/2019)	
14	03/04/2019	Joint STIPULATION TO EXTEND TIME for Plaintiff to answer Defendant's counterclaims to March 7, 2019 - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 03/04/2019)	
	03/04/2019	SO ORDERED re 14 Joint STIPULATION TO EXTEND TIME for Plaintiff to answer Defendant's counterclaims to March 7, 2019 (Set/Reset Answer Deadlines: Rein Tech, Inc. answer due 3/7/2019). ORDERED by Judge Maryellen Noreika on 3/4/2019. (dlw) (Entered: 03/04/2019)	
15	03/08/2019	Joint STIPULATION TO EXTEND TIME to Answer Defendant's Counterclaims to March 8, 2019 - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 03/08/2019)	
16	03/08/2019	MOTION to Strike Defendant's Affirmative Defenses, MOTION to Dismiss Based upon Fed. R. Civ. P. 12(B)(6) - filed by Rein Tech, Inc. (Devlin, Timothy) Modified on 3/8/2019 (dlw). (Entered: 03/08/2019)	
17	03/08/2019	OPENING BRIEF in Support re 16 MOTION to Strike Defendant's Affirmative Defenses MOTION to Dismiss Based upon Fed. R. Civ. P. 12(B)(6) filed by Rein Tech, Inc..Answering Brief/Response due date per Local Rules is 3/22/2019. (Devlin, Timothy) (Entered: 03/08/2019)	
18	03/08/2019	ANSWER to 10 Answer to Complaint, Counterclaim by Rein Tech, Inc. (Devlin, Timothy) (Entered: 03/08/2019)	
	03/08/2019	SO ORDERED re 15 Joint STIPULATION TO EXTEND TIME to Answer Defendant's Counterclaims to March 8, 2019. ORDERED by Judge Maryellen Noreika on 3/8/2019. (dlw) (Entered: 03/08/2019)	
19	03/21/2019	STIPULATION TO EXTEND TIME for Defendant Mueller Water Products, Inc. to respond to Plaintiff's Motion to Strike Defendant's Affirmative Defenses and Motion to Dismiss Defendant's Counterclaims to March 29, 2019 - filed by Mueller Water Products, Inc.. (Dorsney, Kenneth) (Entered: 03/21/2019)	
	03/21/2019	SO ORDERED re 19 STIPULATION TO EXTEND TIME for Defendant Mueller Water Products, Inc. to respond to Plaintiff's Motion to Strike Defendant's Affirmative Defenses and Motion to Dismiss Defendant's Counterclaims to March 29, 2019 (Set Briefing Schedule: re 16 MOTION to Strike Defendant's Affirmative Defenses MOTION to Dismiss Based upon Fed. R. Civ. P. 12(B)(6) - Answering Brief due 3/29/2019). ORDERED by Judge Maryellen Noreika on 3/21/2019. (dlw) (Entered: 03/21/2019)	
20	03/29/2019	ANSWERING BRIEF in Opposition re 16 MOTION to Strike Defendant's Affirmative Defenses MOTION to Dismiss Based upon Fed. R. Civ. P. 12(B)(6) filed by Mueller Water Products, Inc..Reply Brief due date per Local Rules is 4/5/2019. (Dorsney, Kenneth) (Entered: 03/29/2019)	
21	04/22/2019	MOTION to Withdraw 16 MOTION to Strike Defendant's Affirmative Defenses MOTION to Dismiss Based upon Fed. R. Civ. P. 12(B)(6) - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 04/22/2019)	
	04/23/2019	SO ORDERED re 21 MOTION to Withdraw 16 MOTION to Strike Defendant's Affirmative Defenses; MOTION to Dismiss Based	

1:18cv1683, Rein Tech, Inc. V. Mueller Systems, Llc

#	Date	Proceeding Text	Source
		upon Fed. R. Civ. P. 12(B)(6). Motions terminated: 16 MOTION to Strike Defendant's Affirmative Defenses; MOTION to Dismiss Based upon Fed. R. Civ. P. 12(B)(6). ORDERED by Judge Maryellen Noreika on 4/23/2019. (dlw) (Entered: 04/23/2019)	
22	04/23/2019	ORAL ORDER: IT IS HEREBY ORDERED that the parties shall confer regarding proposed dates in the scheduling order and shall submit a proposed order, including a proposal for the length and timing of trial, to the Court no later than thirty (30) days from the date of this Order. The parties are to use the Court's form scheduling order, which is posted at http://www.ded.uscourts.gov (see Chambers, Judge Noreika, Forms). If there are disputes or issues that the Court needs to address in the proposed scheduling order, the parties shall direct the Court to the paragraph numbers in which those appear in a cover letter to the Court. ORDERED by Judge Maryellen Noreika on 4/23/2019. (dlw) (Entered: 04/23/2019)	
23	05/23/2019	PROPOSED ORDER Scheduling Order by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 05/23/2019)	
24	06/03/2019	SCHEDULING ORDER: Case referred to the Magistrate Judge for the purpose of exploring ADR. Joinder of Parties due by 1/15/2020. Amended Pleadings due by 1/15/2020. Fact Discovery completed by 8/7/2020. Opening Expert Reports due by 8/28/2020. Rebuttal Expert Reports due by 9/18/2020. Reply Expert Reports due by 10/9/2020. Expert Discovery due by 11/13/2020. Dispositive Motions due by 12/14/2020. Answering Brief due 1/18/2021. Reply Brief due 2/12/2021. Claim Construction Opening Brief served by 11/6/2019. Claim Construction Answering Brief served by 12/9/2019. Claim Construction Reply Brief served by 1/13/2020. Claim Construction Surreply Brief served by 2/10/2020. Joint Claim Construction Brief filed by 2/24/2020. A Markman Hearing is set for 3/24/2020 at 09:00 AM before Judge Maryellen Noreika. A Pretrial Conference is set for 5/3/2021 at 04:30 PM in Courtroom 4A before Judge Maryellen Noreika. A 7-day Jury Trial is set for 5/10/2021 at 09:30 AM in Courtroom 4A before Judge Maryellen Noreika. SEE ORDER FOR COMPLETE DETAILS. Signed by Judge Maryellen Noreika on 6/3/2019. (dlw) (Entered: 06/03/2019)	
	06/03/2019	CASE REFERRED to Magistrate Judge Christopher J. Burke for Mediation. Please see Standing Order dated January 20, 2016, regarding disclosure of confidential ADR communications. A link to the standing order is provided here for your convenience at http://www.ded.uscourts.gov/general-orders/magistrate-judges-standing-order-adr-mediation (cak) (Entered: 06/03/2019)	
25	06/04/2019	ORAL ORDER: If during the history of this case, Plaintiff(s) and Defendant(s) jointly wish to schedule a form of alternative dispute resolution ("ADR"), such as mediation, with Judge Burke, they should contact chambers by e-mail at Deborah_Benyo@ded.uscourts.gov or by phone. Additionally, if either side wishes to speak ex parte with Judge Burke regarding ADR matters, they may contact chambers via e-mail or by phone to arrange a time for a call. Ordered by Judge Christopher J. Burke on 6/4/2019. (dlb) (Entered: 06/04/2019)	
26	06/13/2019	STIPULATION TO EXTEND TIME for the parties to submit a Proposed Protective Order to June 21, 2019 - filed by Mueller Water Products, Inc.. (Dorsney, Kenneth) (Entered: 06/13/2019)	
	06/13/2019	SO ORDERED re 26 STIPULATION TO EXTEND TIME for the parties to submit a Proposed Protective Order to June 21, 2019. ORDERED by Judge Maryellen Noreika on 6/13/2019. (dlw) (Entered: 06/13/2019)	

SHANETTE BROWN

1:18cv1683, Rein Tech, Inc. V. Mueller Systems, Llc

#	Date	Proceeding Text	Source
27	06/13/2019	NOTICE OF SERVICE of Defendant Mueller Water Products, Inc.'s Rule 26(a)(1) Initial Disclosures filed by Mueller Water Products, Inc..(Dorsney, Kenneth) (Entered: 06/13/2019)	
28	06/14/2019	NOTICE OF SERVICE of Rule 26(a)(1) Initial Disclosures filed by Rein Tech, Inc..(Devlin, Timothy) (Entered: 06/14/2019)	
29	06/19/2019	Unopposed MOTION to Substitute Party: Mueller Systems, LLC to replace Mueller Water Products, Inc. - filed by Rein Tech, Inc. (Devlin, Timothy) Modified on 6/20/2019 (dlw). (Entered: 06/19/2019)	
	06/20/2019	SO ORDERED re 29 Unopposed MOTION to Substitute Party: Mueller Systems, LLC to replace Mueller Water Products, Inc. ORDERED by Judge Maryellen Noreika on 6/20/2019. (dlw) (Entered: 06/20/2019)	
30	06/21/2019	STIPULATION TO EXTEND TIME for the parties to submit a Proposed Protective Order to June 28, 2019 - filed by Mueller Systems, LLC. (Dorsney, Kenneth) (Entered: 06/21/2019)	
	06/24/2019	SO ORDERED re 30 STIPULATION TO EXTEND TIME for the parties to submit a Proposed Protective Order to June 28, 2019. ORDERED by Judge Maryellen Noreika on 6/24/2019. (dlw) (Entered: 06/24/2019)	
31	06/28/2019	PROPOSED ORDER // Agreed Protective Order by Rein Tech, Inc. (Devlin, Timothy) Modified on 7/1/2019 (dlw). (Main Document 31 replaced on 7/1/2019) (dlw). (Entered: 06/28/2019)	
	07/01/2019	CORRECTING ENTRY: D.I. 31 has been replaced on the docket with a version that contains signature blocks and signatures of counsel. (dlw) (Entered: 07/01/2019)	
32	07/01/2019	PROTECTIVE ORDER. Signed by Judge Maryellen Noreika on 7/1/2019. (dlw) (Entered: 07/01/2019)	
33	07/15/2019	NOTICE OF SERVICE of (1) Mueller's Paragraph 3 Disclosures; and (2) Mueller's Core Technical Documents filed by Mueller Systems, LLC.(Dorsney, Kenneth) (Entered: 07/15/2019)	
34	07/16/2019	NOTICE OF SERVICE of Initial Disclosures under Paragraph 3 of the District of Delaware Default Standard for Discovery, Including Discovery of Electronically Stored Information filed by Rein Tech, Inc..(Devlin, Timothy) (Entered: 07/16/2019)	

Patents

Number	Title	Issued	Class	Subclass
8,347,427	Water use monitoring apparatus	01/08/2013	4	643
9,297,150	Water use monitoring apparatus and water damage prevention system	03/29/2016	1	1
9,749,792	Water use monitoring apparatus	08/29/2017	1	1

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SHANETTE BROWN

1:18cv1684, Rein Tech, Inc. V. Xylem, Inc.

US District Court Docket

US District Court for the District of Delaware

(Wilmington)

This case was retrieved on 08/05/2019

Header

Case Number: 1:18cv1684
Date Filed: 10/26/2018
Assigned To: Judge Maryellen Noreika
Nature of Suit: Patent (830)
Cause: Patent Infringement
Lead Docket: None
Other Docket: 1:18cv01682, 1:18cv01683
Jurisdiction: Federal Question

Class Code: Closed
Closed: 03/13/2019
Statute: 35:271
Jury Demand: Plaintiff
Demand Amount: $0
NOS Description: Patent

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Email:Peter@corcoranip.Com

Xylem, Inc.
Defendant

Proceedings

#	Date	Proceeding Text	Source
1	10/26/2018	COMPLAINT FOR PATENT INFRINGEMENT filed with Jury Demand against Xylem, Inc. - Magistrate Consent Notice to Pltf. (Filing fee $ 400, receipt number 0311-2490499.) - filed by Rein Tech, Inc. (Attachments: # 1 Exhibits 1-6, # 2 Exhibits 7-12, # 3 Exhibits 13-16, # 4 Civil Cover Sheet)(ceg) (Entered: 10/26/2018)	
2	10/26/2018	Notice, Consent and Referral forms re: U.S. Magistrate Judge jurisdiction. (ceg) (Entered: 10/26/2018)	
3	10/26/2018	Report to the Commissioner of Patents and Trademarks for Patent/Trademark Number(s) US 8,347,427 B2; US 9,297,150 B2;	

1:18cv1684, Rein Tech, Inc. V. Xylem, Inc.

#	Date	Proceeding Text	Source
		US 9,749,792 B2; US 9,494,480 B2. (ceg) (Entered: 10/26/2018)	
	10/26/2018	Summons Issued with Magistrate Consent Notice attached as to Xylem, Inc. on 10/26/2018. Requesting party or attorney should pick up issued summons at the Help Desk, Room 4209, or call 302-573-6170 and ask the Clerk to mail the summons to them. (ceg) (Entered: 10/26/2018)	
4	10/26/2018	Disclosure Statement pursuant to Rule 7.1: No Parents or Affiliates Listed filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 10/26/2018)	
5	10/30/2018	SUMMONS Returned Executed by Rein Tech, Inc.. Xylem, Inc. served on 10/29/2018, answer due 11/19/2018. (Devlin, Timothy) (Entered: 10/30/2018)	
6	10/30/2018	MOTION for Pro Hac Vice Appearance of Attorney Peter J. Corcoran, III - filed by Rein Tech, Inc.. (Devlin, Timothy) (Entered: 10/30/2018)	
	10/31/2018	Case Assigned to Judge Maryellen Noreika. Please include the initials of the Judge (MN) after the case number on all documents filed. Associated Cases: 1:18-cv-01682-MN, 1:18-cv-01683-MN, 1:18-cv-01684-MN (rjb) (Entered: 10/31/2018)	
	11/01/2018	SO ORDERED re 6 MOTION for Pro Hac Vice Appearance of Attorney Peter J. Corcoran, III filed by Rein Tech, Inc. ORDERED by Judge Maryellen Noreika on 11/1/2018. (dlw) (Entered: 11/01/2018)	
	11/02/2018	Pro Hac Vice Attorney Peter J. Corcoran for Rein Tech, Inc. added for electronic noticing. Pursuant to Local Rule 83.5 (d)., Delaware counsel shall be the registered users of CM/ECF and shall be required to file all papers. (lak) (Entered: 11/02/2018)	
7	03/13/2019	NOTICE of Voluntary Dismissal by Rein Tech, Inc. as to Defendant (Devlin, Timothy) (Entered: 03/13/2019)	
8	03/13/2019	SO ORDERED re 7 Notice of Voluntary Dismissal. ***Civil Case Terminated. Signed by Judge Maryellen Noreika on 3/13/2019. (dlw) (Entered: 03/13/2019)	
9	03/14/2019	Report to the Commissioner of Patents and Trademarks for Patent/Trademark Number(s). (Attachments: # 1 Notice of Voluntary Dismissal)(mdb) (Entered: 03/14/2019)	

Patents

Number	Title	Issued	Class	Subclass
8,347,427	Water use monitoring apparatus	01/08/2013	4	643
9,297,150	Water use monitoring apparatus and water damage prevention system	03/29/2016	1	1
9,494,480	Water use monitoring apparatus	11/15/2016	1	1
9,749,792	Water use monitoring apparatus	08/29/2017	1	1

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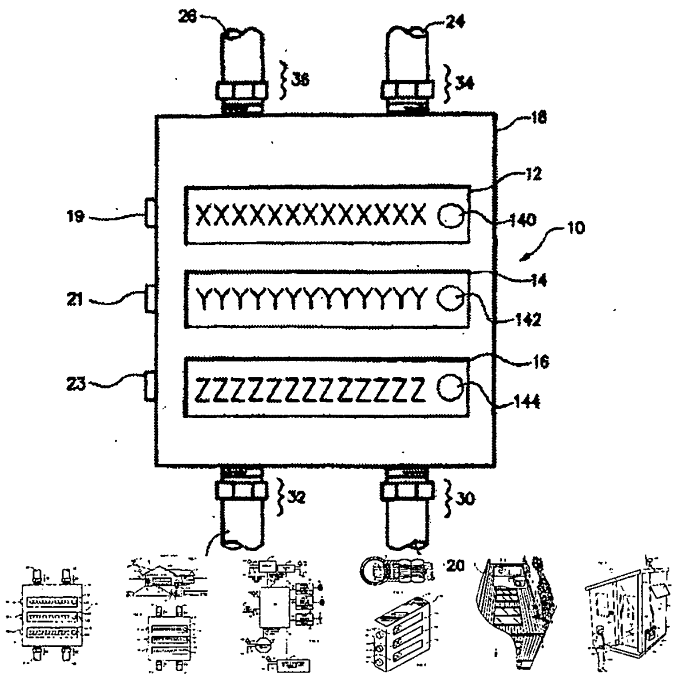
SHANETTE BROWN

TotalPatent One®

US20160163177A1 - Water Use/Water Energy Use Monitor and/or Leak Detection System

The present invention is a water use/water energy use monitor and/or leak detection system designed to cooperate with a residential or industrial/commercial facility water supply system. The system is comprised of a building or structure water use/water energy use monitor and/or leak detection apparatus base station with shut-off/on mechanism that is in wireless (Wi-Fi, Bluetooth/ZigBee or cellular, or wired technology (X10, Zwave, UPB) communication with a convenient controller. The base station with shut-off/on mechanism is interposed within a water line from a water main to the living or operating quarters portion of a residential or a industrial/commercial facility or building, such that activation of the base station with shut-off/on valve operates monitor water use and to prevent flow of water from the water main to the living quarters when the residential home or industrial/commercial facility or building is vacated unsupervised.



Last viewed: August 6 2019, 10:36 AM

Bibliographic information

Claims

Publication US20160163177A1

	06/09/2016	
Application	**US15016178**	02/04/2016
Priority	**US13776963**	02/26/2013
Original assignee	**Michael Edward Klicpera**	
Current assignee	**Klicpera, Michael Edward**	
Inventor	**Michael Edward Klicpera**	
Status	Filed	

1 .1 . A building or structure water use/water energy use monitor and/or leak detection apparatus, said apparatus comprising: a base station interposed between a water line, from a main water supply and a water supply for said building or structure, said base station having electrical circuitry with wireless capability; said base station having one or more flow sensors designed to monitor the water use from a residential home or industrial/commercial facility or building; a wireless cell phone, smart phone or similar apparatus in wireless communication with said base station; said base station periodically uploading or transferring water use data, water energy use data, and/or water quality data wireless to the local router/server, to the internet and/or to remote computers ("the cloud"); and

Total of 100% of claims loaded.

Families

INPADOC (https://worldwide.espacenet.com/pu
CC=US&NR=2016163177A1&KC=A1&FT

This section contains all family relations of this particular document. For more information about the different families please refer to the Manual (Glossary/Families).

(https://worldwide.espacenet.com/publicationDetails/inpadocPatentFamily?CC=US&NR=2016163177A1&KC=A1&FT=D&ND=&date=20160609&DB=&locale=)

Extended	Complete	Main	Domestic	Application number	Publication	Title	Status

Similar documents

The similarity check is done by matching this document to all documents in the database. Only the title and abstract text are matched, resulting in a score. The 10 highest scoring documents are shown here.

Citations

Citation	Authority	Normalized number	Application date	Publication number	Publicati date
backward	US	5267587	04/07/1992	US5267587A	12/07/19
backward	US	6237618	07/06/2000	US6237618B1	05/29/20
backward	US	6556142	09/20/2001	US6556142B2	04/29/20
backward	US	20050235306	12/15/2004	US200502353...	10/20/20
backward	US	20060137090	12/28/2005	US200601370...	06/29/20

Page:

Description

RELATED APPLICATIONS

[0001] This application is a continuation. U.S. patent application Ser. No. 13/776,963 filed on Feb. 26, 2013 and is incorporated herein by this reference.

FIELD OF THE INVENTION

[0002] This apparatus and the method of use relates to water supplying systems. More particularly, the invention relates to a water monitor and water detection system whereby real time water use and leak detection in relation to residential and industrial/commercial facility or building damage.

BACKGROUND OF THE INVENTION

[0003] Water conservation is becoming a major issue for many cities towns, and communities and an apparatus for real time monitoring of water and water energy uses at specific residential, corporate, (or government) sites could be useful in supporting water conservation and in assessing and controlling water resources. Periodic droughts and increased population that

escalates the demand for fresh water sources which is a humanity concern.

[0004] In addition, losses to residential property and industrial/commercial facilities caused by broken water pipes, or unobserved leaks are staggering. In part because broken water pipes often go undetected in the absence of the property owner or while the property owner sleeps through the night, water damage from a broken water pipe can be catastrophic. In fact some insurance agencies report that up to seventy percent of their insurance losses are water related.

[0005] Furthermore, it has been reported that in residential homes, leaks still amount to a significant percentage of the total water use.

Total of 100% of description loaded.

Classifications

IPC

G08B21/18
E03B7/12

CPC

G08B21/18
E03B7/071
E03B7/12
F16K31/02
F16K31/05
Y02A20/15
Y10T137/8158

Persons

Original Assignees

Original	Standardized	Normalized
Michael Edward Klicpera San Diego		

Current Assignees

Original	Standardized	Normalized
Klicpera, Michael Edward	KLICPERA, MICHAEL EDWARD	

Inventor(s)

Original

Original

Michael Edward Klicpera
San Diego

Legal information

Status

Event	Date
Filed	02/04/2016

Ownership

Date from	Date to	Name	Standardized	Normalized
02/26/2013		Klicpera, Michael Edward	KLICPERA, MICHAEL EDWARD	

Payment status

Date	Payment status	Description

Litigation

Lexis Advance®
Research

Results for: 9297150 OR 9,297,150

News (8) Sort by: Relevance

1. Stock Weekly: Carbonite drops 3.6%, 2 weeks' volume in a week

   News Bites US Markets | Aug 02, 2019 | 15259 words
   AMERICAN WEEKLY STOCK REPORT Dateline: Saturday August 03, 2019 Carbonite Inc. (NASDAQ :CARB), NASDAQ 's 25th largest Computer software company by market cap, has decreased 64.0c (or 3.6%) in the past week to close at $US17.37. The volume was 2 times average weekly trading of 2.9 million shares. Compared with the NASDAQ -100 Index which fell 324.1 points (or 4.0%) in the week, this represented a relative price increase of 0.5%. In the past week the market cap has declined $US22 million. INSTITUTIONAL BUYING Carbonite (NASDAQ :CARB) institutional shareholder ...

2. US Patent Issued on March 29 for "Water use monitoring apparatus and water damage prevention system" (California Inventor)

   US Fed News | Apr 01, 2016 | 290 words
   ALEXANDRIA , Va. , April 1 -- United States Patent no. 9,297,150, issued on March 29. "Water use monitoring apparatus and water damage prevention system" was invented by Michael Edward Klicpera (La Jolla, Calif.). According to the abstract* released by the U.S. Patent & Trademark Office: "The present invention is a water damage prevention system that has a residential or industrial/commercial facility water supply interruption system. The system is comprised of a remotely controllable base station with shut-off/on mechanism that is in wireless or wired communication with a convenient controller. The base station ...

3. Klicpera Michael Edward Obtains Patent for Water Use Monitoring Apparatus and Water Damage Prevention System

   Global IP News. Environmental Patent News | Mar 30, 2016 | 315 words
   FULL TEXT Publication Name: Enviornmental Patent News Patent Application Number: 13/776,963 Patent Publication Number: 9,297,150 International Patent Classification Codes: E03B 7/071 (20130101), F16K 31/02 (20130101), F16K 31/05 (20130101), Y10T 137/8158 (20150401) Patent Status: Granted Alexandria, March 30 -- Klicpera Michael Edward has obtained a patent for water use monitoring apparatus and water damage prevention system. This invention was developed by Klicpera Michael Edward. The patent application number is 13/776,963. The International Patent Classification codes are F16K 31/02 (20060101), E03B 7/07 (20060101) and F16K 31/05 (20060101). Cooperative Patent Classification codes are ...

4. MAAX Inc. Achieves Strong Growth in Sales and Profitability During the Second Quarter

   PR Newswire | Oct 15, 2003 | FINANCIAL NEWS 4908 words
   - 14.5% increase in net income - 13.4% sales growth - 25.0% gain in operating cash flows SAINTE-MARIE, Quebec , Oct. 15 /PRNewswire-FirstCall/ - MAAX Inc. (TSX: MXA) hereby announces results for the second quarter ended August 31, 2003. During this quarter, the Company's net income rose 14.5% to $11.4 million or $0.47 per share, up from $9.9 million or $0.41 per share in the same quarter of the previous fiscal year. The net margin ...

5. MAAX Inc. Achieves Strong Growth in Sales and Profitability During the Second Quarter; - 14.5% increase in net income - 13.4% sales growth - 25.0% gain in operating cash flows

   Canada NewsWire | Oct 15, 2003 | FINANCIAL NEWS | 4943 words
   MAAX Inc. (TSX: MXA) hereby announces results for the second quarter ended August 31, 2003. During this quarter, the Company's net income rose 14.5% to $11.4 million or $0.47 per share, up from $9.9 million or $0.41 per share in the same quarter of the previous fiscal year. The net margin therefore improved to 6.8% from 6.7%

in the second quarter of last year. The Company further expanded its North American market share with a 13.4% growth in its consolidated sales which totalled $166.9 million, compared with $147.2 million a year earlier. The increase in the Canadian dollar led ...

6. AMAG Pharmaceuticals, Inc. Reports Financial Results for the Quarter Ended September 30, 2007

Business Wire Oct 25, 2007 1479 words
AMAG Pharmaceuticals, Inc. (NASDAQ : AMAG), a biopharmaceutical company that utilizes its proprietary nanoparticle technology for the development and commercialization of therapeutic iron compounds to treat anemia, as well as novel imaging agents to aid in the diagnosis of cancer and cardiovascular disease, today reported unaudited consolidated financial results for the quarter and nine months ended September 30, 2007. As of September 30, 2007, the Company's cash, cash equivalents, short-term and long-term investments totaled $291.8 million. Revenues for the quarter ended September 30, 2007 were $0.5 million as compared to revenues of $0.4 million for the ...

7. Burton Group PLC Rule 8 Disclosure.

London Stock Exchange Aggregated Regulatory News Service (ARNS) Aug 07, 1996 478 words
BURTON GROUP Date of Disclosure.7TH AUGUST 1996....... DISCLOSURE UNDER RULES 8.1(a), 8.1(b)(i) and 8.3 ...

8. Some of the properties of heat-treated sessile oak;Quercus petraea.

ASAPII Database Aug 01, 2010 Pg. 473(8); ISSN: 0015-7473; Vol. 60; No. 5 7550 words Korkut, SuleymanKarayilmazlar, SelmanHiziroglu, SalimSanli, Tolunay
Abstract The objective of this study was to investigate the effects of heattreatment on the physical and mechanical properties of sessile oak (Quercus petraea). Samples were exposed to three temperature levels of120[degrees]C, 150[degrees]C, and 180[degrees]C for time periods ranging from 2 to 10 hours. Modulus of elasticity, modulus of rupture, compression strength parallel-to-grain, hardness, impact bending, tension strength, swelling in three sections, and surface roughness of the samples were evaluated. Based on the findings in this study, the results.showed a significant difference between properties of control samples and heat-treated samples (P = 0.05). Mechanical properties of the samples were adversely ...

Content type: News
Terms: 9297150 OR 9,297,150
Search Type: Boolean - Fewer Results
Narrow By: Sources: News
Date and Time: Aug 06, 2019 10:37:17 a.m. EDT

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PTO/SB/57 (01-18)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

(Also referred to as FORM PTO-1465)

REQUEST FOR *EX PARTE* REEXAMINATION TRANSMITTAL FORM

Address to:
Mail Stop *Ex Parte* Reexam
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Attorney Docket No.: 70947.01

Date: 7/31/2019

1. ☒ This is a request for *ex parte* reexamination pursuant to 37 CFR 1.510 of patent number 9,297,150 issued Mar. 29, 2016. The request is made by:
   ☒ patent owner. ☐ third party requester.

2. ☒ The name and address of the person requesting reexamination is:
   Rein Tech, Inc. in care of Inventor Michael Klicpera
   P.O. Box 1164
   Alamo, CA

3. Requester ☒ asserts small entity status (37 CFR 1.27) or ☐ certifies micro entity status (37 CFR 1.29). Only a patent owner requester can certify micro entity status. Form PTO/SB/15A or B must be attached to certify micro entity status.

4. This request is accompanied by payment of the reexamination fee as set forth in:
   ☐ 37 CFR 1.20(c)(2); **or**
   ☒ 37 CFR 1.20(c)(1). **In checking this box for payment of the fee set forth in 37 CFR 1.20(c)(1), requester asserts that this request has forty (40) or fewer pages and complies with all other requirements of 37 CFR 1.20(c)(1).**

   Payment of the reexamination fee is made by the method set forth below.
   a. ☐ A check in the amount of $_______________ is enclosed to cover the reexamination fee;
   b. ☐ The Director is hereby authorized to charge the reexamination fee to Deposit Account No. ________________________;
   c. ☐ Payment by credit card. Form PTO-2038 is attached; **or**
   d. ☒ Payment made via EFS-Web.

   ☐ In addition, the Director is hereby authorized to charge any fee deficiencies to Deposit Account No. ________________________.

5. ☒ Any refund should be made by ☐ check or ☐ credit to Deposit Account No.__________________. 37 CFR 1.26(c). If payment is made by credit card, refund must be to credit card account.

6. ☒ A copy of the patent to be reexamined having a double column format on one side of a separate paper is enclosed. 37 CFR 1.510(b)(4).

7. ☐ CD-ROM or CD-R in duplicate, Computer Program (Appendix) or large table
   ☐ Landscape Table on CD

This collection of information is required by 37 CFR 1.510. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) a request for reexamination. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop *Ex Parte* Reexam, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/SB/57 (01-18)
Approved for use through 11/30/2021. OMB 0651-0064
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

8. ☐ Nucleotide and/or Amino Acid Sequence Submission
If applicable, items a. – c. are required.
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. ☐ CD-ROM (2 copies) or CD-R (2 copies) **or**
      ii. ☐ paper
   c. ☐ Statements verifying identity of above copies.

9. ☒ A copy of any disclaimer, certificate of correction or reexamination certificate issued in the patent is included.

10. ☒ Reexamination of claim(s) 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 28 is requested.

11. ☒ A copy of every patent or printed publication relied upon is submitted herewith including a listing thereof on Form PTO/SB/08, PTO-1449, or equivalent.

12. ☐ An English language translation of all necessary and pertinent non-English language patents and/or printed publications is attached.

13. ☒ The attached detailed request includes at least the following items:
   a. A statement identifying each substantial new question of patentability based on prior patents and printed publications. 37 CFR 1.510(b)(1).
   b. An identification of every claim for which reexamination is requested, and a detailed explanation of the pertinency and manner of applying the cited art to every claim for which reexamination is requested. 37 CFR1.510(b)(2).

14. ☒ A proposed amendment is included (only where the patent owner is the requester). 37 CFR 1.510(e).

15. ☒ It is certified that the statutory estoppel provisions of 35 U.S.C. 315(e)(1) or 35 U.S.C. 325(e)(1) do not prohibit requester from filing this *ex parte* reexamination request. 37 CFR 1.510(b)(6).

16. Service
   a. ☐ It is certified that a copy of this request (if filed by other than the patent owner) has been served in its entirety on the patent owner as provided in 37 CFR 1.33(c).

   The name and address of the party served are:

   ____
   ____
   ____

   Date of Service: ______________________________

OR

   b. ☐ A duplicate copy is enclosed since service on patent owner was not possible. An explanation of the efforts made to serve patent owner **is attached**. <u>See</u> MPEP 2220.

PTO/SB/57 (01-18)
Approved for use through 11/30/2021. OMB 0651-0064
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

17. Correspondence Address: Direct all communication about the reexamination to:

[x] The address associated with Customer Number: 22509

OR

[ ] Firm or Individual Name ______
(at the address identified below)

Address

City	State	Zip

Country

Telephone	Email

18. [ ] The patent is currently the subject of the following concurrent proceeding(s):

a. [ ] Copending reissue Application No. ______

b. [ ] Copending reexamination Control No. ______

c. [ ] Copending Interference No. ______

d. [x] Copending litigation styled:
U.S. Patent No. 9,297,150 is currently being asserted in Rein Tech, Inc. v.
Mueller Systems, LLC, No. 1:18-cv-01683-MN (D. Del., filed Oct. 26, 2018).

WARNING : Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

/Michael Klicpera/	7/31/2019
Authorized Signature	Date
Michael Klicpera	38044
Typed/Printed Name	Registration No.

[x] For Patent Owner Requester [ ] For Third Party Requester

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE REEXAMINATION OF U.S. PATENT NO. 9,297,150

INVENTOR: MICHAEL EDWARD KLICPERA

FILED: FEBRUARY 26, 2013

FOR: WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM

PETITION UNDER 35 U.S.C. § 311 FOR EX PARTE REEXAMINATION OF

U.S. PATENT 9,297,150

MAIL STOP INTER PARTES REEXAMINATION
ATTN: CENTRAL REEXAMINATION UNIT
COMMISSIONER FOR PATENT
P.O. Box 1450
ALEXANDRIA, VA 22313-1450

Ex Parte Reexamination is petitioned in accordance with 35 U.S.C. § 302 and 37 C.F.R. §1.501 and 37 C.F.R. §1.510 for U.S. Patent No. 9,297,150 (hereinafter "the '150 Patent"). Substantial New Questions of Patentability (SNQs) are presented herein, based on additional prior art that has been brought to the Patent Holder's attention during litigation proceedings.

As required by 37 C.F.R. § 1.150(b)(1), a statement pointing out each substantial new question of patentability base on prior patents and printed publications.

As required by 37 C.F.R. § 1.150(b)(2), a full listing of the patents and printed publications presented to provide a substantial new question of patentability is included on a submitted with this petition, which is attached hereto, together with a full copy of each listed document in Exhibit A.

The submitted art was neither not previously provided to the USPTO or considered in the light presented to issuance of the '150 Patent.

Petitioner also petitions corrections of the specification.

TABLE OF CONTENTS

TABLE OF EXHIBITS

A. IDENTIFICATION OF CLAIMS FOR WHICH REEXAMINATION IS PETITIONED

B. STATEM POINTING OUT EACH SUBSTANTIAL NEW QUESTION OF PATENTABILITY

C. In accordance with 37 CFR 1.510, reexamination of claims 8-19 and 28 in view of the following references.

(PA 1) "Utility Meter Reading System" U.S. Patent 5,719,564 to Lawrence Sears (hereinafter "Sears") published on 2/17/1998, Prior Art under 35 U.S.C. §102(b) or 103(a)

(PA 2) "Universal Utility Usage Data Gathering System" U.S. Patent 6,181,257 to Jean Meek (hereinafter "Meek"), published on 1/30/2001, Prior Art under 35, §102(b) or 103(a)

(PA 3) "Wireless Meter Reading System and Methods Thereof" U.S. Patent 7,310,052 to Eric Bowman (hereinafter "Bowman"), published on 1/11/2007, Prior Art under 35 U.S.C. §102(b) or 103(a)

(PA 4) "Method and System for Providing Web-Enabled Cellular Access to Meter Reading Data U.S. Patent 8,644,804 to Morrice Blackwell et. al. (hereinafter "Blackwell '804"), published on 4/7/2011, prior art under 35 U.S.C. §102(b) or 103(a)

(PA 5) "Valve Meter Assembly and Method" U.S. Patent 8,833,390 to Marty Scott Ball (hereinafter "Ball") published on 12/6/2012, Prior Art under 35 U.S.C. §102(b) or 103(a)

(PA 6) "Energy Manager-Water Leak Detection" U.S. Patent 9,019,120 to Jay Andrew Broniak (hereinafter "Broniak") published on 4/25/2015, Prior Art under 35 U.S.C. §102(b) or 103(a)

(PA 7) "Method and System for Providing Web-Enabled Cellular Access to Meter Reading Data" U.S. Patent 9,709,421 to Morrice Blackwell (hereinafter "Blackwell '421") published on 10/30/2014, prior art under 35 U.S.C. §102(b) or 103(a)

(PA 8) "Water Management System" U.S. Published Application 2011/0035603 to Saju Anthony Palayur (hereinafter "Palayur") published on 2/10/2011, Prior Art under 35 U.S.C. §102(b) or 103(a)

D. CLAIM CHARTS (CC)

(CC1) 35 U.S.C. § 102(b) Sears anticipates claims 8-19 and 28 of the '150 Patent

(CC2) 35 U.S.C. § 102(b) Meek anticipates claims 8-19 and 28 of the '150 Patent

(CC3) 35 U.S.C. § 102(b) Bowman anticipates claims 8-19 and 28 of the '150 Patent

(CC4) 35 U.S.C. § 102(b) Blackwell '804 anticipates claims 8-19 and 28 of the '150 Patent

(CC5) 35 U.S.C. § 102(b) Ball anticipates claims 8-19 and 28 of the '150 Patent

(CC6) 35 U.S.C. § 102(b) Broniak anticipates claims 8-19 and 28 of the '150 Patent

(CC7) 35 U.S.C. § 102(b) Blackwell '421 anticipates claims 8-19 and 28 of the '150 Patent

(CC8) 35 U.S.C. § 102(b) Palayur anticipates claims 8-19 and 28 of the '150 Patent

E. Amended Specification and Claims

F. Additional Information Disclosure Statement

G. Claim Charts

I. CONCURRENT PROCEEDINGS

U.S. Patent No. 9,297,150 is currently being asserted in *Rein Tech, Inc. v. Mueller Systems, LLC*, No. 1:18-cv-01683-MN (D. Del., filed Oct. 26, 2018).

II. REQUIREMENT FOR EX PARTE REEXAMINATION

UNDER 37 C.F.R. § 1.510

The Real Party in Interest is Rein Tech, Inc.

A. 37 C.F.R. § 1.510(b)(1)

Under 35 USC § 302 and 37 CFR 1.510(b)(1), a statement pointing out each substantial new question of patentability based on the cited patents and printed publication, and a detailed explanation of the pertinence and manner of applying the patent and printed publications to claims 8-19, and 28 of the '150 Patent is presented on pages 5-7 below and accompany claim charts. The relevant and cited patents disclosure water meters with leak detection capabilities, utilizing flow sensors, having one or more display means, and including one or more wireless communication means for transferring water parameter data and information to one or more remote monitoring apparatuses. Further shown in the claim charts is a comparison of claims 8-19 and 28 versus the disclosures in the cited prior art patents

B. 37 C.F.R. § 1.510 (b)(2)

Pursuant to 37 C.F.R. § 1.195(b)(2) of every patent or printed publication relied upon to present an SNQ is submitted herein. All of these cited prior art publications constitute effective art references to the claims of the '150 Patents.

C. 37 C.F.R. § 1.510 (b)(3)

A full copy of this '150 Patent is submitted herein.

D. 37 C.F.R. § 1.150 (b)(4)

Since the inventor and owner of the '150 Patent is voluntarily submitting the '150 Patent for Reexamination, there is no requirement or need to server this Reexamination to any other entity.

E. 37 C.F.R. § 1.150 (b)(5)

Pursuant to 37 C.F.R. § 1.915(b)(5), Petitioner and Inventor Michael Edward Klicpera certifies that the ex partes reexamination estoppels provisions do not prohibit the filing of this *Ex Parte* reexamination.

An authorization registered with the Financial Manager Account of the Inventor to cover the $3000 Streamlined fee is attached. If this authorization is missing or defective, please charge the Fee to Deposit Account No. 502274.

III. GENERAL OVERVIEW OF THE ART REFERENCES IN THE PETITION

This petition presents the following art referenced patents and patent publications.

(PA 1) "Utility Meter Reading System" to Lawrence Sears	Published on 2/17/1998
(PA 2) "Universal Meter Reading System" to Jean Meek	Published on 1/30/2001
(PA 3) "Wireless Meter Reading System and Methods Thereof" to Eric Bowman	Published on 1/11/2007
(PA 4) "Method and System for Providing Web-Enabled Cellular Access to Meter Reading Data U.S. Patent 8,644,804 to Morrice Blackwell et. al.	Published on 4/4/2011
(PA 5) "Valve Meter Assembly and Method" to Marty Ball	Published on 12/06/2012
(PA 6) "Energy Manager-Water Leak Detection" to Andrew Broniak	Published on 4/25/2015
(PA 7) "Method and System for Providing Web-Enabled Cellular Access to Meter Reading Data" U.S. Patent 9,709,421 to Morrice Blackwell	Published on 10/30/2014
(PA 8) "Water Management System" to Saju Anthony Palayur	Published on 2/10/2011

The Sears, Meek, Bowman, Blackwell '804, Ball, Broniak, Blackwell '421 and the Palayur were not of record in the file of the '150 Patent.

REEXAMINATION OF CLAIMS 8-19 AND 28 IS PETITIONED IN VIEW OF SEARS

Sears raises a substantial new question of patentability for claims 8-19 and 28 as shown in the accompanying charts because it discloses a method for communicating utility usage-related information from a plurality of meter modules to a plurality of data accumulator units, each of which periodically transmits data to a control computer, including the steps of periodically transmitting from each meter module a first signal indicative of utility usage-related information and wherein the first signal includes a flag for self-configuring the communications network when the meter module is initially installed. The signal strength of the first signals from a meter module received at a data accumulator unit are measured and ranked by the control computer based on received signal strength. The ranking based on signal strength is utilized to enable only a limited number of data accumulators (those which received the strongest first signals) to receive, record and store data from a particular meter module.

REEXAMINATION OF CLAIMS 8-19 AND 28 IS PETITIONED IN VIEW OF MEEK

Meek raises a substantial new question of patentability for claims 8-19 and 28 as shown in the accompanying charts because it discloses a universal utility usage data gathering system that is capable of operating with any other read pad data gathering system, regardless of protocol. The universal system comprises of two components. One--a transponder which is the actual device that accumulates utility usage and will transfer accumulated usage to a reader/interrogator system. Two--the universal reader/interrogator, which will universally read any transponder for which the reader is programmed to accept from the transponder read pad. The universal reader/interrogator is based on standard micro-

electronic chips and utilizes a multi-tapped antenna making the device capable of communicating with any transponder. The universal reader/interrogator will determine what protocol from any transponder.

REEXAMINATION OF CLAIMS 8-19 AND 28 IS PETITIONED IN VIEW OF BOWMAN

Bowman raises a substantial new question of patentability for claims 8-19 and 28 as shown in the accompanying charts because it discloses a wireless meter-reading system includes a utility meter having a housing and a face and a recording device located in the housing. The recording device is adapted to read and convert data located on a portion of the face to wirelessly transmittable data. A power source coupled to the recording device permits continuous and instantaneous capture of the wirelessly transmittable data from the face of the utility meter by the recording device. A communication device provided for wirelessly receiving and transmitting data between a consumer site and a utility provider site facilitates monitoring of the face of the utility meter by the consumer site and by the utility provider site. A method for allowing a consumer to join a secured wireless network of a utility provider comprises the consumer paying a fee to the utility provider. Both the consumer and the utility provider benefit from this arrangement.

REEXAMINATION OF CLAIMS 8-19 AND 28 IS PETITIONED IN VIEW OF BLACKWELL '804

Blackwell raises a substantial new question of patentability for claims 8-19 and 28 as shown in the accompanying charts because it discloses a method and a system for collection of meter readings from meter reading and transmitting devices and for viewing on a web-enabled wireless communication device comprises addressing at least one receiver through the Internet and obtaining a data file of meter data for a plurality of meter reading devices that have previously communicated with the receiver. The receiver can then re-transmit the meter data through a wide area network such as the Internet to a web site operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone which receives a web page that is reduced in size for transmission through the cellular network to the smart phone

REEXAMINATION OF CLAIMS 8-19 AND 28 IS PETITIONED IN VIEW OF BALL.

Ball raises a substantial new question of patentability for claims 8-19 and 28 as shown in the accompanying charts because it discloses a valve meter device including a housing defining at least one inlet opening and at least one outlet opening and a channel connecting the openings where the water meter configured to monitor control the flow of water through the valve meter device with a water control valve. Ball also discloses a wireless communication unit 2310 that include a wireless communication unit circuit 2925. The wireless communication unit circuit 2925 may be configured to log the status of the solenoid 270. For example, the communication unit circuit 2925 may log whether the solenoid 270 is in the open or closed position. Ball has a publication date of December 6, 2012 and a filing date of May 31, 2011.

REEXAMINATION OF CLAIMS 8-19 AND 28 IS PETITIONED IN VIEW OF BRONIAK

Broniak raises a substantial new question of patentability for claims 8-19 and 28 as shown in the accompanying charts because it discloses a system for monitoring water leaks within a home having a network with various devices monitors these devices with a controller. Information is received from a water flow meter via a transceiver for tracking a total water flow amount through pipelines in the home. By comparing information collected to a predetermined threshold, a leak is determined as present or not within each pipeline. Upon the detection of a leak in the home, a homeowner is notified of the condition

so that action is taken expeditiously. A shut off valve can be triggered remotely when a petition is received from the user, which closes the water pipeline to prevent water damage.

REEXAMINATION OF CLAIMS 8-19 AND 28 IS PETITIONED IN VIEW OF BLACKWELL '421

Blackwell raises a substantial new question of patentability for claims 8-19 and 28 as shown in the accompanying charts because it discloses a method and a system for collection of meter readings from meter reading and transmitting devices and for viewing on a web-enabled wireless communication device comprises addressing at least one receiver through the Internet and obtaining a data file of meter data for a plurality of meter reading devices that have previously communicated with the receiver . The receiver can then re-transmit the meter data through a wide area network such as the Internet to a web site operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone which receives a web page that is reduced in size for transmission through the cellular network to the smart phone.

REEXAMINATION OF CLAIMS 8-19 AND 28 IS PETITIONED IN VIEW OF PALAYUR.

Palayur raises a substantial new question of patentability for claims 8-19 and 28 as shown in the accompanying charts because it discloses a water consumption monitoring and control system comprised of a base unit, comprising a display and a data entry device, a microprocessor, a communication link to water meters, pressure sensors, temperature sensors, flush toilet vibration sensors and shut-off valves. In addition, the base unit has access to the Internet and can access a server which holds a database of water conservation information. This database includes watering advisories from the local government, and weather information from the weather office. Palayur discloses that the communication links 23 can include communication from the sensors to the actuators. This communication can be implemented by means of a wire or wirelessly for example, by means of ISM band transceivers, Zigbee or WiFi. The communication also includes access to the Internet, either wirelessly, or by means of a wired ethernet.

/Michael Klicpera/

Michael Klicpera

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13776963
	Filing Date	2013-02-26
	First Named Inventor	KLICPERA
	Art Unit	3753
	Examiner Name	JELLETT
	Attorney Docket Number	70947.01

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8833390	B2	2014-09-16	BALL	Fig. 1-2, 11, 23, 29, and 31, Col. 3, lines 17-67,Col. 4, lines 1-31, Col. 8, lines 20-32, Col. 111 lines 7-28, Col. 12, lines 23-42, Col. 16, lines 17-67, Col. 17, lines 1-44
	2	9253754	B2	2016-02-02	SANDERFORD	Fig. 2 and 4, Col. 7, lines 2-67, Col. 9, lines 65-67, Col. 10, lines 1-43
	3	6539968	B1	2003-04-01	WHITE	Fig. 4 and 6, Col. 2, lines 43-51, Col. 5, lines 35-50, Claim 1
	4	5660198		1997-08-26	McCLARAN	Fig. 1, Col. lines 35-49, Col. 2, lines 15-25, 55-60, Col. 3, lines 10-40
	5	5636653		1997-06-10	TITUS	Fig. 2 and 16, Col. 2, lines 35-67, Col. 3, lines 1-3, Col. 4, lines 38-67, Col. 5, lines 1-67, Col. 6, lines 1-53, Col. 12, lines 42-60
	6	6105607	B2	2000-08-22	CAISE	Fig. 7, Col. 3, lines 33-67. Col. 5, lines 53-56
	7	6543479	B2	2003-04-08	COFFEY	Fig. 2, 4, and 5, Col. 2, lines 14-67, Col. 3, lines 38-56
	8	9019120	B2	2015-04-28	BRONIAK	Fig. 1, 2, and 3, Col. 3, lines 1-19, 52-67, Col. 4, lines 1-37, 56-63, Col. 5 lines 1-67

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	9	4949976		1990-07-10	GASTOUNIOTIS	Fig. 1, Col. 3 lines 7-67, Col. 3 lines 40-65
	10	5298894		1994-03-29	CERNY	Fig. 2, 3, and 5, Col. 3 lines 6-52
	11	8539827	B2	2012-08-02	BENSON	Fig. 1, Col. 1 lines 45-48, Col.2 lines 47-57, 61-64, Col. 3 lines 3-4, 17-30, 64-67
	12	8644804	B2	2011-04-07	BLACKWELL	Col. 1 lines 7-10, 53-55, Col. 2 lines 31-33, 51-85. Col. 2 lines 63-76, Col. 3 lines 1-11
	13	8878690	B2	2010-12-23	OLSON	Fig. 2,3, 4, and 5, Col. lines 61-62, Col. 4 lines 3-8, 43-60, Col. 3, lines 22-25
	14	7012546	B2	2002-07-02	ZIGDON	Col. 5 lines 33-43, Col. 7 lines 12-19, 36-40, Col. 8, lines 35-38, Col. 10 lines 14-18
	15	8269651	B2	2006-11-02	ZIGDON	Col. 4 lines 46-58, Col. 5, lines 39-43, Col. 7 lines 2-6, 24-29, 36-40, Col. 8 lines 25-28,Col. 9 lines 66-67, Col. 10 lines 1-3, Col. 16 lines 47-4
	16	7626511	B2	2007-12-13	LAZAR	Col. 1 lines 104, Col. 3 lines 2-6, 21-26, 37-42, 54,60
	17	7605717	B2	2009-10-20	OLSON	Col. 2, lines 38-60, Col. lines 1-50, Col. 3 lines 1-14
	18	8217804	B2	2012-07-10	LAUGHLIN-PARKER	Col. 1, lines 14-60, Col. 3 lines 24-67
	19	8625722	B2	2014-01-07	ROUQUETTE	Col. 3 lines 5-50, Col. 6, lines 41-50, Col. 7 lines 17-47, Col. 8 lines 59-67, Col. 14, lines 32-43

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	Attorney Docket Number	70947.01

	20	8602384	B2	2013-12-10	WILLIAMSON	Fig. 1, Col. 2, lines 44-57
	21	5971011		1999-10-26	PRICE	Abstract, Col. 2, line 7-67, Col. 4, lines 7-28

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code1	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20040193329	A1	2004-09-30	RANSOM	Paragraphs 107, 110, 116, 118-123, 124-125, 127, 129, 133, 143, 144-145, 150, 162, 163-164, 166-167, 168, 173-174, 194.
	2	20080149180	A1	2008-08-26	PARRIS	Fig. 1, 7, 8,15 and 16, Paragraphs 96, 99, 109, 117, 121, 123, 141, 151, 156, 159-163, 171-173, 205, 212 220-221
	3	20080295895	A1	2008-12-04	VINCENT	Paragraphs 1, 10, 11, 13, 14
	4	20110035063	A1	2011-02-10	PALAYUR	Fig. 1-10, 14, 16-17, Paragraphs 8, 15, 16, 22-25, 36, 40, 69, 75, 80, 84, 91

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number3	Country Code2 i	Kind Code4	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T5
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	Art Unit	3753
	Examiner Name	JELLETT
	Attorney Docket Number	70947.01

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Art Unit	3753
	Examiner Name	JELLETT
	Attorney Docket Number	70947.01

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☒ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael Edward Klicpera	Date (YYYY-MM-DD)	2019-08-02
Name/Print	Michael Edward Klicpera	Registration Number	38044

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

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4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

CC1

US. Patent 9,297,150 Claim Chart - Sears 5,719,564

'150 Claim 8 CC1	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A method for communicating utility usage-related information from a plurality of meter modules to a plurality of data accumulator units, each of which periodically transmits data to a control computer, including the steps of periodically transmitting from each meter module a first signal indicative of utility usage-related information and wherein the first signal includes a flag for self-configuring the communications network when the meter module is initially installed. The signal strength of the first signals from a meter module received at a data accumulator unit are measured and ranked by the control computer based on received signal strength. The ranking based on signal strength is utilized to enable only a limited number of data accumulators (those which received the strongest first signals) to receive, record and store data from a particular meter module.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Fig. 1, 4, Col. 4, lines 15-20 While a cell phone 22 has been illustrated to communicate between the data accumulator units 18 and the control computer 24, other data links, such as RF, phone lines, cable, or photo-optic transmissions means can be utilized in a well-known manner to connect the data accumulator units 18 to the control computer 24. Col 9, lines 51-59 In the preferred embodiment the data accumulator units 18 are adapted to communicate with the computer on a periodic basis and the control computer 24 can not communicate with each data accumulator unit 18 unless the cell phone of the data accumulator unit 18 has established a communications link with the control computer 24. This mode of operation consumes much less energy than if the data accumulation unit 18 was constantly "on" looking for a message from the control computer 24. The utilization of a data accumulator unit 18 which periodically transmits its data and then denergizes

	its data transfer circuitry until the next periodic transmission allows the unit 18 to be powered by a battery and a solar cell. However, in some cases it may be desirable to establish a two-way communication link with the data acumulator units 18 and this can be acomplished by providing a transmitting-receiving cell phone or an RF link with the control computer.
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	
said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC1	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC1	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	

'150 Claim 11 CC1	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC1	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC1	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	
'150 Claim 14 CC1	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	

'150 Claim 15 CC1	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 4, lines 15-20 While a cell phone 22 has been illustrated to communicate between the data accumulator units 18 and the control computer 24, other data links, such as RF, phone lines, cable, or photo-optic transmissions means can be utilized in a well-known manner to connect the data accumulator units 18 to the control computer 24. Col 9, lines 51-59 In the preferred embodiment the data accumulator units 18 are adapted to communicate with the computer on a periodic basis and the control computer 24 can not communicate with each data accumulator unit 18 unless the cell phone of the data accumulator unit 18 has established a communications link with the control computer 24. This mode of operation consumes much less energy than if the data accumulation unit 18 was constantly "on" looking for a message from the control computer 24. The utilization of a data accumulator unit 18 which periodically transmits its data and then denergizes its data transfer circuitry until the next periodic transmission allows the unit 18 to be powered by a battery and a solar cell. However, in some cases it may be desirable to establish a two-way communication link with the data acumulator units 18 and this can be acomplished by providing a transmitting-receiving cell phone or an RF link with the control computer.
'150 Claim 16 CC1	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC1	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	

'150 Claim 18 CC1	
19. building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	
'150 Claim 19 CC1	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC1	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 28 CC1	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

CC2

US. Patent 9,297,150 Claim Chart -- Meek 6,181,257

'150 Claim 8 CC2	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A universal utility usage data gathering system that is capable of operating with any other read pad data gathering system, regardless of protocol. The universal system comprises of two components. One--a transponder which is the actual device that accumulates utility usage and will transfer accumulated usage to a reader/interrogator system. Two--the universal reader/interrogator, which will universally read any transponder for which the reader is programmed to accept from the transponder read pad. The universal reader/interrogator is based on standard micro-electronic chips and utilizes a multi-tapped antenna making the device capable of communicating with any transponder. The universal reader/interrogator will determine what protocol from any transponder.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 14, lines 30-36 The transponder communicates with its reader using electromagnetic waves launched from a coil or winding within the transponder, unless the meter is part of an Automatic Meter Reading (AMR) system. (AMR systems utilize hard wired transmission lines, telephone lines, cell-phone transmissions, PCS transmissions, or similar dedicated data transmission lines.)
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC2	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC2	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC2	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC2	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC2	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC2	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC2	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 14, lines 30-36 The transponder communicates with its reader using electromagnetic waves launched from a coil or winding within the transponder, unless the meter is part of an Automatic Meter Reading (AMR) system. (AMR systems utilize hard wired transmission lines, telephone lines, cell-phone transmissions, PCS transmissions, or similar dedicated data transmission lines.)
'150 Claim 16 CC2	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC2	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC2	
19. building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	
'150 Claim 19 CC2	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	

'150 Claim 20 CC2	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 28 CC2	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

<u>CC3</u>

US. Patent 9,297,150 Claim Chart - Bowman 7,310,052

'150 Claim 8 CC3	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A wireless meter-reading system includes a utility meter having a housing and a face and a recording device located in the housing. The recording device is adapted to read and convert data located on a portion of the face to wirelessly transmittable data. A power source coupled to the recording device permits continuous and instantaneous capture of the wirelessly transmittable data from the face of the utility meter by the recording device. A communication device provided for wirelessly receiving and transmitting data between a consumer site and a utility provider site facilitates monitoring of the face of the utility meter by the consumer site and by the utility provider site. A method for allowing a consumer to join a secured wireless network of a utility provider comprises the consumer paying a fee to the utility provider. Both the consumer and the utility provider benefit from this arrangement.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	Fig. 4, Col. 6. lines 53-55 It is understood that without limitation the utility meter 12 may comprise at least one of an electric meter, a gas meter, a water meter, and the like.
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 6, lines 3-19 Alternatively, the communication device 30 may be at least one of a satellite (depicted as a portion of a block diagram denoted "receiver and transmitter") and a cell phone network (depicted as a portion of a block diagram denoted "receiver and transmitter"), and the like. The communication device 30 is wirelessly coupled to the recording device 12 (such as a wireless cell phone). It is understood that when the communication device 30 is coupled to a wireless cell phone, the wireless cell phone further comprises at least a recording device 12 such as a digital camera, and the like. The wireless cell phone may be programmed to respond to transmissions from both the customer site 36 and the utility company site 38. Each one of the satellite and the cell phone network is adapted to relay data from the recording device 12 located in the housing 22 of the utility meter 14 to the consumer site 36 and to the utility provider site 38.

said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	
said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC3	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC3	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC3	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	

'150 Claim 12 CC3	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC3	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	
'150 Claim 14 CC3	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC3	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 6, lines 3-19 Alternatively, the communication device 30 may be at least one of a satellite (depicted as a portion of a block diagram denoted "receiver and transmitter") and a cell phone network (depicted as a portion of a block diagram denoted "receiver and transmitter"), and the like. The communication device 30 is wirelessly coupled to the recording device 12 (such as a wireless cell phone). It is understood that when the communication device 30 is coupled to a wireless cell phone, the wireless cell phone further comprises at least a recording device 12 such as a digital camera, and the like. The wireless cell phone may be programmed to respond to transmissions from both the customer site 36 and the utility company site 38. Each one of the satellite and the cell phone network is adapted to relay data from the recording device 12 located in the housing 22 of the utility meter 14 to the consumer site 36 and to the utility provider site 38.
'150 Claim 16 CC3	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	

'150 Claim 17 CC3	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC3	
19. building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	
'150 Claim 19 CC3	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC3	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 28 CC3	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

<u>CC4</u>

US. Patent 9,297,150 Claim Chart – Blackwell 8,644,804

'150 Claim 8 CC4	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A method and a system for collection of meter readings from meter reading and transmitting devices (12, 14) and for viewing on a web-enabled wireless communication device (28) comprises addressing at least one receiver (15) through the Internet (21) and obtaining a data file of meter data for a plurality of meter reading devices (12, 14) that have previously communicated with the receiver (15). The receiver (15) can then re-transmit the meter data through a wide area network such as the Internet (21) to a web site (10) operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone (28) which receives a web page (22) that is reduced in size for transmission through the cellular network to the smart phone (28).
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 2, lines 55-58 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 1, lines 59-64 The wireless communication device is preferably a web-enabled wireless communication device, such as a Blackberry web-enabled cellular phone, another web-enabled cellular phone or personal digital assistant (PDA).
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	Col. 2, lines 55-58 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
'150 Claim 9 CC4	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC4	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC4	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC4	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC4	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC4	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC4	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 1, lines 53-58 The method and system of the present invention can run on a web site that can be reached through a GSM or other cellular network. The method of the invention further includes reading a file of meter data in the form of an HTML web page, which is then modified for viewing on a web-enabled handheld wireless communication device.
'150 Claim 16 CC4	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC4	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC4	
19. building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	Col. 2, lines 39-41 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 21.

'150 Claim 19 CC4	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC4	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 28 CC4	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	Col. 2, lines 39-41 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 21.

CC5

US. Patent 9,297,150 Claim Chart – Ball 8,833,390

'150 Claim 8 CC5	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A valve meter device, assembly, and method is disclosed including a housing defining at least one inlet opening and at least one outlet opening and a channel connecting the openings, the at least one inlet opening having an inlet end and the at least one outlet opening having an outlet end; a water meter positioned in the channel, the water meter configured to monitor a flow of water through the valve meter device; and a valve in communication with the channel and configured to control the flow of water through the valve meter device. In some embodiments, a linear distance exists between the inlet end and the outlet end, the linear distance being no greater than a standard water meter lay-length.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	Figs. 3, 4, 5, 6, Col. 4, lines 39-43, The inlet threaded portion 315 and the outlet threaded portion 325 allow for attachment to a piping system, including an upstream piping system or a downstream piping system or both.
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 3, line 18-20 Disclosed is a valve meter device, a valve meter assembly, and a method for remotely reading a water meter and controlling a water supply valve.
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC5	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC5	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC5	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC5	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC5	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC5	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC5	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	
'150 Claim 16 CC5	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC5	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC5	
19. building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	
'150 Claim 19 CC5	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	

'150 Claim 20 CC5	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 28 CC5	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

<u>CC6</u>

US. Patent 9,297,150 Claim Chart – Broniak 9,019,120

'150 Claim 8 CC6	
8. A building or structure water damage prevention system, said system comprising:	Abstract - Methods and systems are disclosed for monitoring water leaks within a home. A home network with various devices monitors these devices with a controller.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	Col. 3, line 36-40 - A main water meter 52 is operatively connected to the main water inlet pipe 50 for measuring a total amount of water flow into the home and communicating information gathered to the controller 10 via a communication module 56.
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Abstract - A shut off valve can be triggered remotely when a request is received from the user, which closes the water pipeline to prevent water damage. Col. 5, lines 10-24 … the system 8 includes shut off valves 58, 68, and 78 at respective pipelines 50, 60 and 70. The central controller 10 may receive input from the user or homeowner in response to the warning or message, and the user, for example, may respond with instructions to shut off the pipelines 50, 60, and/or 70 via the respective shut off valve 58, 68 and 78
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Fig. 1, Col. 5 lines 59-67 and Col. 6, lines 1-2 Referring back to FIG. 1, the controller 10 further comprises a memory 30 having at least table 32 that collects water consumption data, energy consumption, generation and/or storage data for a home or other structure (e.g., warehouse, business, etc.). The table may additionally comprise variables associated with the heating and cooling conditions of the home, for example. A table is generated for each monitored device that includes historical home data and data that is currently updated, which may be used in a client application running on a device, such as a computer or mobile phone, for presenting graphs or other data to the user.
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	
'150 Claim 9 CC6	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC6	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC6	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC6	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	Col. 5, lines 1-5 For example, if a water flow in pipeline 70 is determined to have a leak, then a text message, email, and/or a user display message may be transmitted via the internet or on the user display 22 to inform the homeowner of a leak.
'150 Claim 13 CC6	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC6	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC6	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 2, lines 3-6 In one embodiment, a home network with a central controller includes at least one water meter or flow meter for measuring water that is consumed by a water consuming device. Col. 1, lines 60-64 The present disclosure provides a method for use within an energy management system that alerts the homeowner of a potential water leak. A central controller (e.g., a home energy manager) communicates wired/wireless signals to one or more water meters coupled to a main water pipeline and/or to various water consuming devices, such as a washer, dishwasher, sinks, toilet, etc throughout the home.
'150 Claim 16 CC6	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC6	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC6	
19. building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	Fig. 2, Col. 5, lines 25-34 A central controller of a home network communicates wirelessly, for example, to radios that are connected to various sensors. There are several ways to accomplish this communication, including but not limited to power line carrier (PLC) (also known as power line communication), FM, AM SSB, WiFi, ZigBee, Radio Broadcast Data System, 802.11, 802.15.4, etc.

'150 Claim 19 CC6	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC5	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	Col. 5, lines 11-21 The central controller 10 may receive input from the user or homeowner in response to the warning or message, and the user, for example, may respond with instructions to shut off the pipelines 50, 60, and/or 70 via the respective shut off valve 58, 68 and 78. In this manner, leaks are detected within a home and homeowners are informed of the conditions in which the water consuming devices operate. Informed decisions regarding water usage are made by the homeowner and potentially catastrophic water destruction in a home is more easily avoided.
'150 Claim 28 CC5	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	

CC7

US. Patent 9,297,150 Claim Chart – Blackwell 9,709421

'150 Claim 8 CC7	
8. A building or structure water damage prevention system, said system comprising:	Abstract - A method and a system for collection of meter readings from meter reading and transmitting devices (12, 14) and for viewing on a web-enabled wireless communication device (28) comprises addressing at least one receiver (15) through the Internet (21) and obtaining a data file of meter data for a plurality of meter reading devices (12, 14) that have previously communicated with the receiver (15). The receiver (15) can then re-transmit the meter data through a wide area network such as the Internet (21) to a web site (10) operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone (28) which receives a web page (22) that is reduced in size for transmission through the cellular network to the smart phone (28).
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 2, lines 59-63 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 1, lines 59-65 The wireless communication device is preferably a web-enabled wireless communication device, such as a Blackberry web-enabled cellular phone, another web-enabled cellular phone or personal digital assistant (PDA).
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	Col. 2, lines 55-63 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data
'150 Claim 9 CC7	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC7	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC7	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC7	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC7	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	

'150 Claim 14 CC7	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	
'150 Claim 15 CC7	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 2, lines 4-12 The invention provides a demonstration tool that can be operated at a customer demonstration site by a sales person as part of a customer presentation without requiring assistance from engineering personnel as practiced in the prior art. The use of a Web application on a web-enabled telephone simulates collection of data at a utility collection site. This will demonstrate the capabilities of the AMR-networked system prior to purchase by utility customers and installation at their premises.
'150 Claim 16 CC7	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC7	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC7	
19. building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	Col. 2, lines 43-49 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 2

'150 Claim 19 CC7	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	
'150 Claim 20 CC7	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	Col. 2, lines 56- 63 As used herein, the term "meter data" should be understood to include either utility consumption data or condition status data, or both. Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.
'150 Claim 28 CC7	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	Col. 2, lines 43-49 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 2

CC8

US. Patent 9,297,150 Claim Chart – Palayur 2011/0035063

'150 Claim 8 CC8	
8. A building or structure water damage prevention system, said system comprising:	Abstract - This invention is a water consumption monitoring and control system comprised of a base unit, itself comprising a display and a data entry device, a microprocessor, a communication link to water meters, pressure sensors, temperature sensors, flush toilet vibration sensors and shut-off valves. In addition, the base unit has access to the Internet and can access a server which holds a database of water conservation information.
a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;	Col. 4, lines 31-33 - As illustrated in FIG. 3, the device housing 110 has an inlet 310 and an outlet 320. Water flows through the device housing 110 by flowing into the inlet 310 and the out of the outlet 320.
said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;	Col. 4, lines 31-33 - As illustrated in FIG. 3, the device housing 110 has an inlet 310 and an outlet 320. Water flows through the device housing 110 by flowing into the inlet 310 and the out of the outlet 320.
a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;	Col. 1, lines 59-64 The wireless communication device is preferably a web-enabled wireless communication device, such as a Blackberry web-enabled cellular phone, another web-enabled cellular phone or personal digital assistant (PDA).
said remotely controllable base station including a recording compliance data means;	
said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;	Fig. 1, Paragraph 50 d) Communication links to several entities located on the Web in particular a server 9, a utility company 14 (water company), a weather information service 15 and user mobile communication devices (e.g., cell phones) **No disclose of an APP**
said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.	Col. 2, lines 55-58 Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.

'150 Claim 9 CC8	
9. A building or structure water damage prevention system as recited in claim 8, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.	
'150 Claim 10 CC8	
10. A building or structure water damage prevention system as recited in claim 8, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.	
'150 Claim 11 CC8	
11. A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.	
'150 Claim 12 CC8	
12. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors	
'150 Claim 13 CC8	
13. A building or structure water damage prevention system as recited in claim 12, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source	
'150 Claim 14 CC8	
14. A building or structure water damage prevention system as recited in claim 8, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.	

'150 Claim 15 CC8	
15. A building or structure water damage prevention system as recited in claim 8, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.	Col. 1, lines 53-58 The method and system of the present invention can run on a web site that can be reached through a GSM or other cellular network. The method of the invention further includes reading a file of meter data in the form of an HTML web page, which is then modified for viewing on a web-enabled handheld wireless communication device.
'150 Claim 16 CC8	
16. A building or structure water damage prevention system as recited in claim 8, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure	
'150 Claim 17 CC8	
17. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.	
'150 Claim 18 CC8	
19. building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone, or similar apparatus utilizes a remote service center to provide further integrity of communication signals.	Col. 2, lines 39-41 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 21.
'150 Claim 19 CC8	
19. A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.	

'150 Claim 20 CC8	
20. building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.	
'150 Claim 28 CC8	
28. A building or structure water damage prevention system as recited in claim 8, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.	Col. 2, lines 39-41 These meter reading devices 12 transmit radio frequency (RF) signals 17 to the receiver 15 to form a local area wireless network. It should be understood that there is typically more than one receiver 15 in a network, although only one is illustrated in FIG. 1. Sometimes the receiver 15 is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network 21.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Klicpera	)
Serial Number: 13/776,963	)
Filed: 02/26/2013	) Art Unit 3753
Examiner: Matthew Jellett	)
For: Water Damage Prevention System	)
Attorney Docket Number: 70947.01	)

REEXAMINATION AMENDMENT

Honorable Commissioner of Patents and Trademarks
Mail Stop Reexamination
P.O. Box 1450
Alexandria, VA 22313-1450

Sir/Madam:

Please amend the above captioned patent application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 4 of this paper.

AMENDMENTS TO THE SPECIFICATION

Please replace Column 10, lines 21- with the following amended paragraphs:

Shown in FIG. 7 is a more detailed description of the electrical circuitry. A timing clock integrated circuit 272 with data transfer means 273 for communicating with the CPU or microprocessor 266 and having a power line 274 and ground line 276. The timing sensor can communicate with the CPU or microprocessor to display such information such as the time of day and current date and/or the total water use ~~totally~~ duration, total volume, and various flow rates ~~that~~ from the water supply ~~has been on before it was turned off~~, or for providing scheduling procedures. Various mechanical and magnetic switches can be utilized to communicate a signal to the CPU or microprocessor 84 that water supply has been turned off and on.

Please replace Col. 11, lines 8-23 with the following amended paragraph:

The CPU will could also have the capability to record water ~~compliance~~ use data, e.g. time and date stamp in a memory bank or chip for recording each time the water system shuts off or turns the water ~~on occurrence~~. [[The]] This water use data is stored in a memory or compliance means comprising a data bank associated with the CPU or a removable memory disk. ~~use data~~ This recorded memory can be used by insurance companies, municipality agencies, third parties, or the owner of a residence or company, to determine if a user utilized ~~the individuals are utilizing~~ the water damage prevention technology or if a during a particular

leak damage event that the water prevention technology was utilized. The memory or compliance use data can be downloaded ~~by a~~ to a removable USB or other solid-state memory drive or other transfer port or transferred wirelessly (or by PSTN) to a support type device, the remote managing operations, or the insurance company, municipality agency or a third party. The use of the data obtained can be presented in various formats or defined formats specified by owner, insurance companies, municipality agencies or third party.

AMENDMENTS TO THE CLAIMS

Listing of the Claims

1. (currently amended) A building or structure water damage prevention system, said system comprising:

a ~~remotely controllable~~ base station with a ~~water shut-off/on or~~ water control mechanism interposed between a water line from a main water main and a water supply for said building or structure;

said base station having electrical circuitry including one or more CPUs, microprocessors or microcontrollers with a power source contained with said base station;

an optional one or more flow rate sensors in communication with a water supply in electrical communication with said electrical circuitry;

one or more first wireless electrical communication means, having the capability to communicate with one or more remote apparatuses and utilizes a confidential format having at least one of an encryption, authentic, integrity and non-repudiate technology;

said power source is either AC powered, DC powered, or powered with one or more batteries that is electrically connected to said electrical circuitry;

said base station with said water control ~~shut-off/on~~ mechanism being adapted to selectively control or prevent

the flow of water through said water supply to said ~~residential home or industrial/commercial~~ building or structure ~~facility or building~~, said water control mechanism in electrical communication with said electrical circuitry;

~~a wireless chain or key fob apparatus;~~

said ~~remotely controllable~~ base station ~~including~~ having the capability to record a water control valve position in a ~~recording~~ memory CPU data bank, USB or other removable solid-state drive, or transfer the water valve position by wireless communication to an offsite computer for optional compliance analysis; ~~compliance data means~~;

a wireless chain or key fob apparatus, ~~said key chain or key fob apparatus includes~~ including electronic circuitry and a second wireless communication that is capable of sending ~~to send~~ a wireless communication signal to said ~~remotely controllable~~ base station to turn said water supply on and off[[,]]; and

said key chain or key fob apparatus having the capability ~~to receive~~ of receiving a wireless electronic communication ~~whereby said key chain or key fob apparatus includes~~ including an indicating means for determining an operational state or position of the water control ~~shut-off/on~~ mechanism.

2. (currently amended) A building or structure water damage prevention system as recited in claim 1, wherein said base station ~~with remotely controllable base station~~ with water control ~~shut-off/on~~ mechanism is interposed between the

water supply line for a sprinkler system and the water distribution lines ~~line~~ for said building or structure, ~~such that~~ such that operation of said sprinkler system is not interrupted by the activation of the base station with water control ~~shut-off/on~~ mechanism.

3. (currently amended) A building or structure water damage prevention system as recited in claim 1, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry being adapted to actuate the shut-off/on mechanism for a programmably determined time.

4. (currently amended) A building or structure water damage prevention system as recited in claim 1, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with water control ~~shut-off/on~~ mechanism is on ~~activated~~.

5. (currently amended) A building or structure water damage prevention system as recited in claim 1, wherein said remotely controllable base station includes one or more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by said one or more flow sensors.

6. (currently amended) A building or structure water damage prevention system as recited in claim 5, further comprising at least one of a water turbine generator, solar cell and ~~and/or~~ wind generation system to provide supplemental electrical energy to said one or more batteries. ~~a battery source.~~

7. (currently amended) A building or structure water damage prevention system as recited in claim 1, wherein said water control ~~shut-off/on~~ mechanism includes a temperature sensor ~~and/or~~ or freeze plug technology for initiating ~~that is designed to initiate~~ operations ~~to prevent~~ preventing water pipe damage during freezing conditions.

8. (currently amended) A building or structure water damage prevention system, said system comprising:

a ~~remotely controllable~~ base station with a water control ~~shut-off/on~~ mechanism interposed between a water line from a water main and a water supply for said building or structure;

said base station having electrical circuitry including one or more CPUs, microprocessors or microcontrollers with a power source contained in said base station apparatus;

said power source is either AC powered, DC powesaid power so red, or powered with one or more batteries electrically connected to said electrical circuitry;

said base station with said water control ~~shut-off/on~~ mechanism being adapted to selectively control or prevent the flow of water through said water supply to said ~~residential home or industrial/commercial facility or~~ building or structure, said water control mechanism in electrical communication with said electrical circuitry;

one or more flow rate sensors communication with said water supply and in electrical communication with said electrical circuitry;

one or more first wireless electrical communication means having the capability of transferring water parameter information or data to one or more remote apparatuses and utilizing protection technology to securely provide water use information or data in a confidential format that utilizes at least one of an encryption, authentic, integrity and non-repudiate technology;

a wireless cell phone, smart phone, or other mobile electronic ~~similar~~ apparatus in wireless communication with said ~~remotely controllable~~ base station with water control ~~shut-off/on~~ mechanism;

said ~~remotely controllable~~ base station ~~including~~ having the capability of recording a water control valve position for optional compliance analysis in a ~~recording~~ memory CPU data bank, USB or other removable solid-state drive, or to an offsite computer by wireless communication transfer ~~compliance data means~~;

said cell phone, smart phone or other mobile electronic ~~similar~~ apparatus ~~designed~~ having an application stored thereon ~~("APP")~~ that is capable of ~~functions~~ to [[send]] sending a wireless signal to said base station~~, said signal functions turning~~ to turn said water supply on, off, or to an intermediary state ~~position~~;

said cell phone, smart phone, or other mobile electronic ~~similar~~ apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for

determining an operational state or position of the water control ~~shut-off/on~~ mechanism, and

said cell phone, smart phone or other mobile electronic ~~similar~~ apparatus having the capability ~~to receive~~ of receiving a wireless electronic communication whereby said cell phone, smart phone or other mobile electronic ~~similar~~ apparatus includes an indicating means for determining the operational state or position of the water control ~~shut-off/on~~ mechanism.

9. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said base station ~~with remotely controllable base station~~ with water control ~~shut-off/on~~ mechanism is interposed between ~~the~~ a water supply line for a sprinkler system and the water distribution lines ~~line~~ for said building or structure, such that such that operation of said sprinkler system is not interrupted by the activation of the base station by said water control ~~with shut-off/on~~ mechanism.

10. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said water base station with water control ~~shut-off/on~~ mechanism further comprises a programmable time circuitry~~, said time circuitry being~~ adapted to actuate the water control ~~shut-off/on~~ mechanism for a ~~programmable~~ progammably determined time.

11. (currently amended) A building or structure water damage prevention system as recited in claim 8, further comprising a mechanical adaptor that enables an override to

allow water flow when the base station with ~~shut-off/on~~ water control mechanism is activated.

12. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said ~~remotely controllable~~ base station includes one or [[of]] more flow sensors and that are capable of being ~~can be~~ programmed to turn off the water supply upon the detection of a leak by said one or more flow sensors.

13. (currently amended) A building or structure water damage prevention system as recited in claim 8 ~~12~~, further comprising at least one of a water turbine generator, solar cell and ~~and/or~~ wind generation system to provide supplemental electrical energy to said one or more batteries ~~a battery source~~.

14. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said water control ~~shut-off/on~~ mechanism includes a temperature sensor or freeze plug technology for initiating ~~that is designed to initiate~~ operations for preventing ~~to prevent a~~ water pipe damage during freezing conditions.

15. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said ~~shut-off/on mechanism~~ one or more ~~includes~~ flow rate sensors measures at least one of a ~~sensor to measure~~ water flow rate, water duration and water volume that can be ~~transfer~~ transferred ~~water flow data or information~~ to said cell phone, smart phone, or other mobile electronic ~~similar~~ apparatus, said base station with water control ~~shut-off/on~~ mechanism and flow sensor interposed between a main water

meter and the water supply for said building or structure, said base station capable of functioning ~~or functions~~ as the main water meter.

16. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said base station water control ~~with shut-off/on~~ mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure.

17. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station and said wireless cell phone, smart phone, or other mobile electronic ~~similar~~ apparatus includes pairing technology ~~to provide~~ that provides a specific wireless communication means between said ~~remotely controllable~~ base station and said wireless cell phone, smart phone or other mobile electronic ~~similar~~ apparatus.

18. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said wireless communication between said ~~remotely controllable~~ base station and said cell phone, smart phone or other mobile electronic ~~similar~~ apparatus utilizes a remote operation service center to provide further integrity of communication signals.

19. (currently amended) A building or structure water damage prevention system as recited in claim 10, wherein said ~~remotely controllable~~ base station calls or sends a text message to the phone, smart phone or other mobile electronic ~~similar~~ apparatus when the phone, smart phone or

other mobile electronic ~~similar~~ apparatus is a defined distance from the ~~remotely controllable~~ base station when the water has not been turned off.

20. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said ~~remotely controllable~~ base station calls or sends a text message to the cell phone, smart phone, or ~~similar~~ other mobile electronic apparatus or communicates with a residential or commercial ~~industrial/commercial~~ owner, [[or]] municipality agency, or insurance company when a leak is detected by one or more leak sensors.

21. (currently amended) A building or structure water damage prevention system, said system comprising:

a ~~remotely controllable~~ base station with a water ~~shut-off/on~~ water control mechanism interposed between a water line from a water main and a water supply for said building or structure;

said base station having electrical circuitry including one or more CPUs, microprocessors or microcontrollers with a power source contained with said base station apparatus;

said power source is either AC powered, DC powered, or powered with one or more batteries and electrically connected to said electrical circuitry;

said base station with said water control ~~shut-off/on~~ mechanism being adapted to selectively control or prevent the flow of water through said water supply to said ~~residential home or industrial/commercial facility or~~

building or structure, said water control mechanism in electrical communication with said electrical circuitry;

an optional one or more flow rate sensors in communication with a water supply and in electrical communication with said electrical circuitry;

one or more first wireless electrical communication means having the capability of communicating with one or more remote apparatuses and utilizes a confidential format that uses at least one of an encryption, authentic, integrity and non-repudiate technology;

said ~~remotely controllable~~ base station ~~including~~ having the capability or recording a water control valve position for optional compliance analysis in a ~~recording~~ memory CPU data bank, USB, other removable solid-state drive, to an offsite computer by wireless communication transfer; ~~compliance data means;~~

~~an alarm or computer system;~~

~~said remotely controllable base station including a recording compliance data means;~~

an alarm or security computer system. said alarm or security computer system including ~~includes~~ electronic circuitry with wireless technology for sending ~~to send~~ a wireless signal to said ~~remotely controllable~~ base station and turning ~~to turn~~ said water supply on and off~~, said wireless signal utilizing encryption, authentic, integrity and/or non-repudiate technology~~; and

13

said alarm or security computer system having the capability or receiving ~~to receive~~ a wireless electronic communication from said base station ~~whereby~~ wherein said alarm or security computer includes an indicating means for determining an operational state or position of the water control ~~shut-off/on~~ mechanism.

22. (currently amended) A building or structure water damage prevention system, said system comprising:

a ~~remotely controllable~~ base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;

said base station having electrical circuitry including one or more CPUs, microprocessors or microcontrollers with a power source contained with said base station apparatus;

said power source is either AC powered, DC powered, or powered with one or more batteries and is electrically connected to said electrical circuitry;

said base station with said water control ~~shut-off/on~~ mechanism being adapted to selectively control or prevent the flow of water through said water supply to said residential home or industrial/commercial facility or building or structure, said water control mechanism in electrical communication with said electrical circuitry;

an optional one or more flow rate sensors in communication with a water supply and in electrical communication with said electrical circuitry;

one or more first wireless electrical communication means having the capability of communicating with one or more remote apparatuses utilizing a confidential format that uses at least one of an encryption, authentic, integrity and non-repudiate technology;

said ~~remotely controllable~~ base station ~~including~~ having the capability of recording a water control valve position for optional compliance analysis in a ~~recording~~ memory CPU data bank, USB, other removable solid-state drive, or an offsite computer by wireless communication transfer; ~~compliance data means;~~

a wireless garage door opener apparatus;

said wireless garage door opener apparatus ~~includes~~ including electronic circuitry ~~to send~~ for sending a wireless signal to said ~~remotely controllable~~ base station to turn said water supply on and off; and

said wireless garage door opener apparatus having the capability of receiving ~~to receive~~ a wireless electronic communication and ~~whereby said wireless garage opener includes~~ having an indicating means for determining an operational state or position of the water control ~~shut-off/on~~ mechanism.

23. (currently amended) A building or structure water damage prevention system as recited in claim 21 wherein said ~~remotely controllable~~ base station includes one [[of]] or more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.

24. (currently amended) A building or structure water damage prevention system as recited in claim 22 wherein said ~~remotely controllable~~ base station includes one or more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.

25. (currently amended) A building or structure water damage prevention system as recited in claim 1, wherein said wireless key chain or key fob apparatus and said ~~remotely controllable~~ base station ~~requires~~ requiring an initial pairing operation for providing ~~to provide~~ a specific wireless communication means between ~~with~~ said wireless key chain or key fob apparatus and said ~~remotely controllable~~ base station.

26. (currently amended) A building or structure water damage prevention system as recited in claim 21, wherein said alarm or computer system and said ~~remotely controllable~~ base station ~~requires~~ requiring an initial pairing technology ~~to provide~~ for providing a specific wireless communication means between ~~with~~ said alarm or computer system and said remotely controllable base station.

27. (currently amended) A building or structure water damage prevention system as recited in claim 22, wherein said wireless garage door opener and said ~~remotely controllable~~ base station ~~requires~~ requiring an initial pairing technology ~~to provide~~ for providing a specific wireless communication means between ~~with~~ said wireless garage door opener and said ~~remotely controllable~~ base station.

28. (currently amended) A building or structure water damage prevention system as recited in claim 8, wherein said

cell phone, smart phone, or other mobile electronic ~~similar~~ apparatus utilizes cell tower and ~~WI-FI~~ wireless communication technology with remote servers and software networks ~~to increase~~ for increasing the integrity of wireless communications and providing security utilizing at least one of an encryption, authentic, integrity and non-repudiate technology ~~cell tower and WI-FI wireless communication~~.

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(12) **United States Patent**
Klicpera

(10) **Patent No.: US 9,297,150 B2**
(45) **Date of Patent: Mar. 29, 2016**

(54) **WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM**

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(72) Inventor: **Michael Edward Klicpera**, La Jolla, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 170 days.

(21) Appl. No.: **13/776,963**

(22) Filed: **Feb. 26, 2013**

(65) **Prior Publication Data**

US 2014/0238511 A1 Aug. 28, 2014

Related U.S. Application Data

(60) Continuation-in-part of application No. 13/541,819, filed on Jul. 5, 2012, which is a continuation-in-part of application No. 13/216,521, filed on Aug. 24, 2011, now Pat. No. 8,347,427, and a continuation-in-part of

(Continued)

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E03B 7/07	(2006.01)
F16K 31/05	(2006.01)

(52) **U.S. Cl.**

CPC ***E03B 7/071*** (2013.01); ***F16K 31/02*** (2013.01); ***F16K 31/05*** (2013.01); *Y10T 137/8158* (2015.04)

(58) **Field of Classification Search**

CPC E03B 7/071; F16K 31/02; F16K 31/05
USPC 137/624.12; 251/129.03, 129.04
See application file for complete search history.

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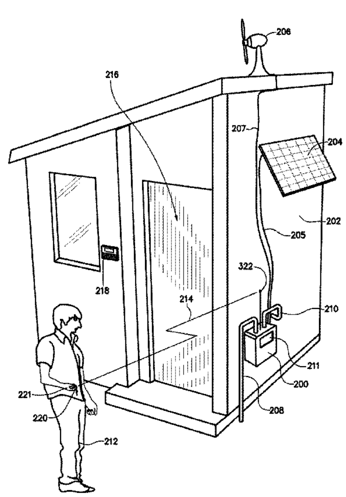
Primary Examiner — Matthew W Jellett
(74) *Attorney, Agent, or Firm* — Michael Edward Klicpera

(57) **ABSTRACT**

The present invention is a water damage prevention system that has a residential or industrial/commercial facility water supply interruption system. The system is comprised of a remotely controllable base station with shut-off/on mechanism that is in wireless or wired communication with a convenient controller. The base station with shut-off/on mechanism is interposed within a water line from a water main to the living or operating quarters portion of a residential or a industrial/commercial facility or building, such that activation of the base station with shut-off/on valve operates to prevent flow of water from the water main to the living quarters when the residential home or industrial/commercial facility or building is vacated or unsupervised. In this manner, damage to the living quarters or the industrial/commercial facility or building from failure of water pipes running through the living or working quarters is prevented during times that the shut-off mechanism is activated.

28 Claims, 9 Drawing Sheets



Related U.S. Application Data

application No. 13/216,497, filed on Aug. 24, 2011, now Pat. No. 8,887,324, which is a continuation-in-part of application No. 12/986,341, filed on Jan. 8, 2011, which is a continuation-in-part of application No. 12/877,094, filed on Sep. 7, 2010, which is a continuation-in-part of application No. 12/539,150, filed on Aug. 11, 2009, now Pat. No. 9,061,307, and a division of application No. 11/877,860, filed on Oct. 4, 2007.

(60) Provisional application No. 61/729,653, filed on Nov. 26, 2012.

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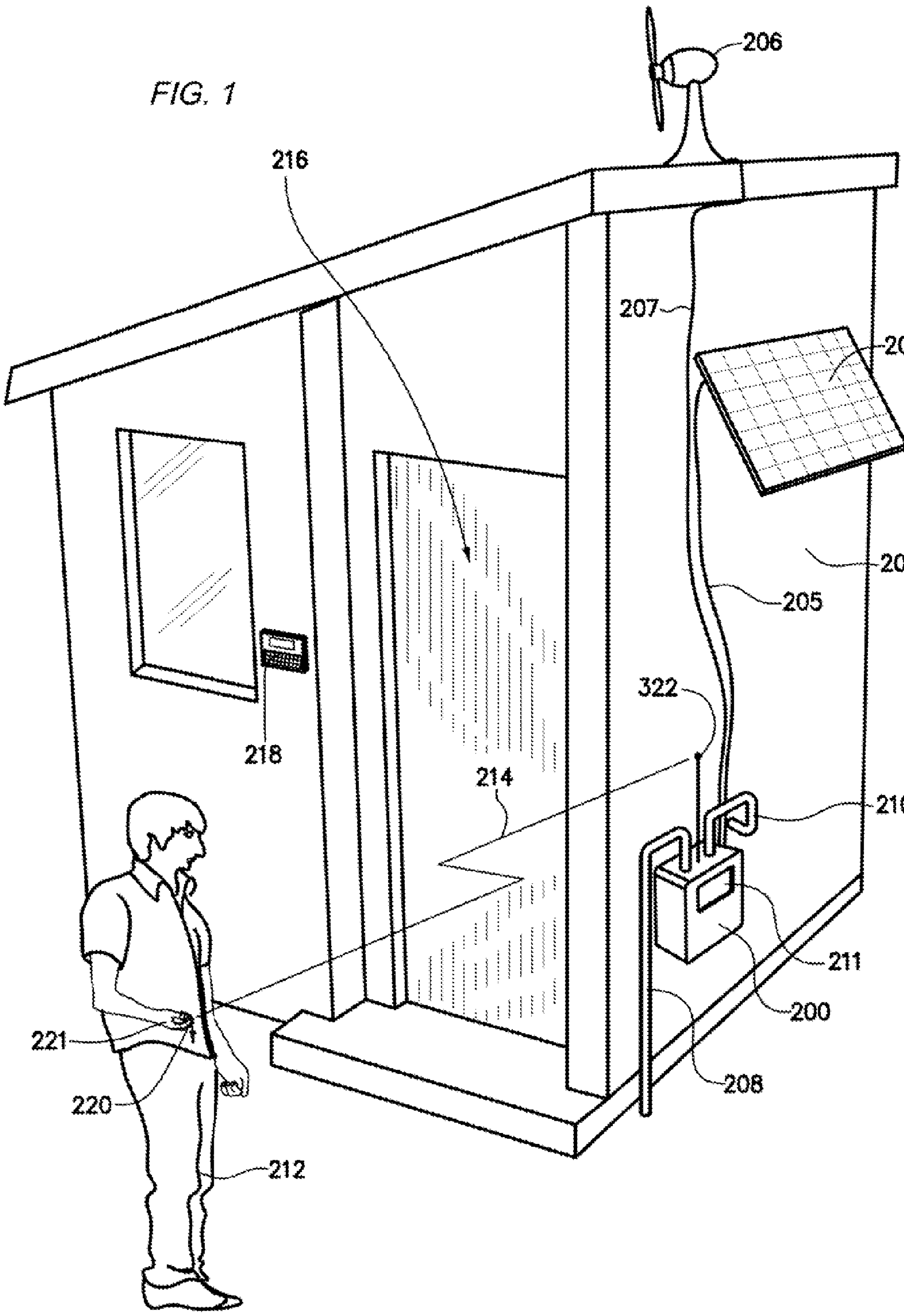
FIG. 1



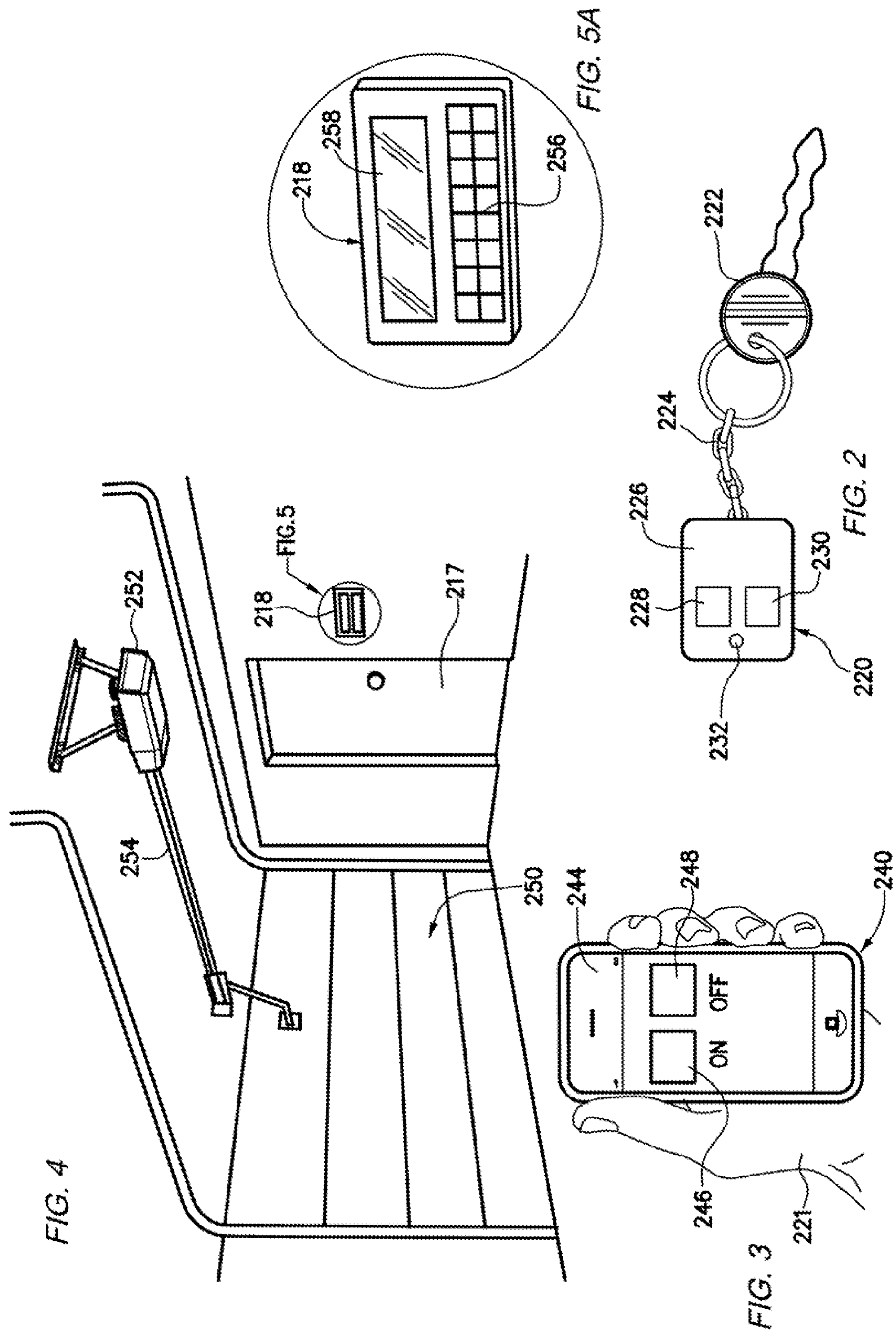


FIG. 5A
218
258
256
222
224
226
FIG. 2
228
230
220
232
252
254
FIG.5
218
217
250
244
248
OFF
ON
240
246
221
FIG. 3
FIG. 4

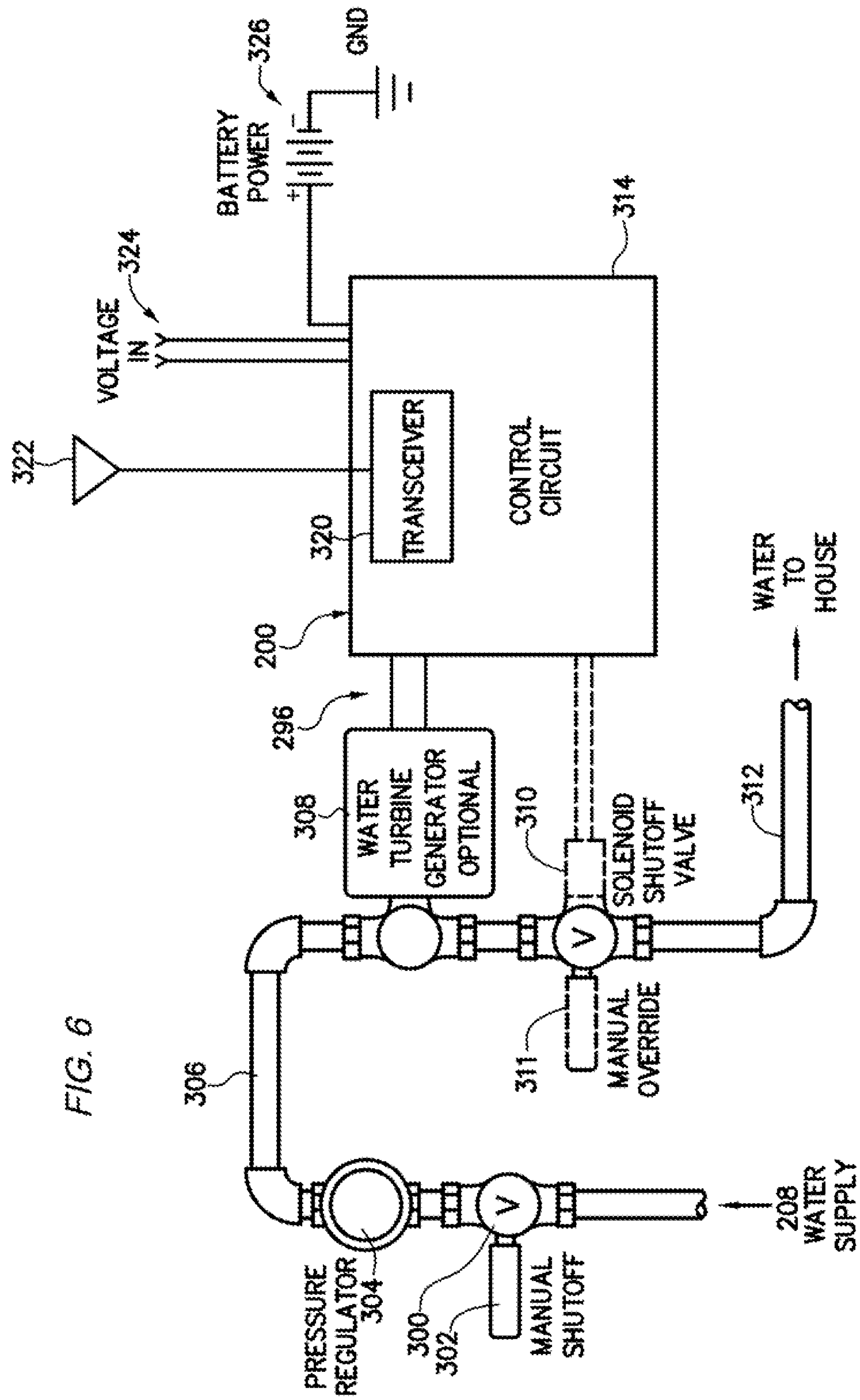

326
GND
BATTERY
POWER
+
–
314
324
VOLTAGE
IN
322
TRANSCEIVER
CONTROL
CIRCUIT
320
200
WATER
TO
HOUSE
296
308
WATER
TURBINE
GENERATOR
OPTIONAL
310
SOLENOID
SHUTOFF
VALVE
312
V
311
MANUAL
OVERRIDE
306
PRESSURE
REGULATOR
304
300
302
MANUAL
SHUTOFF
208
WATER
SUPPLY

FIG. 6

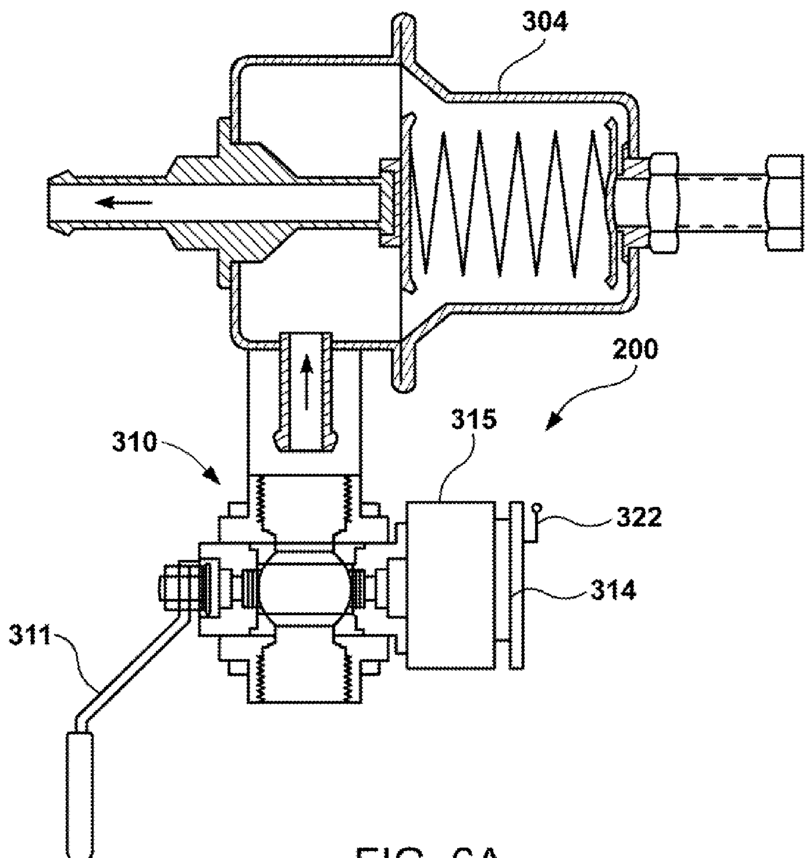
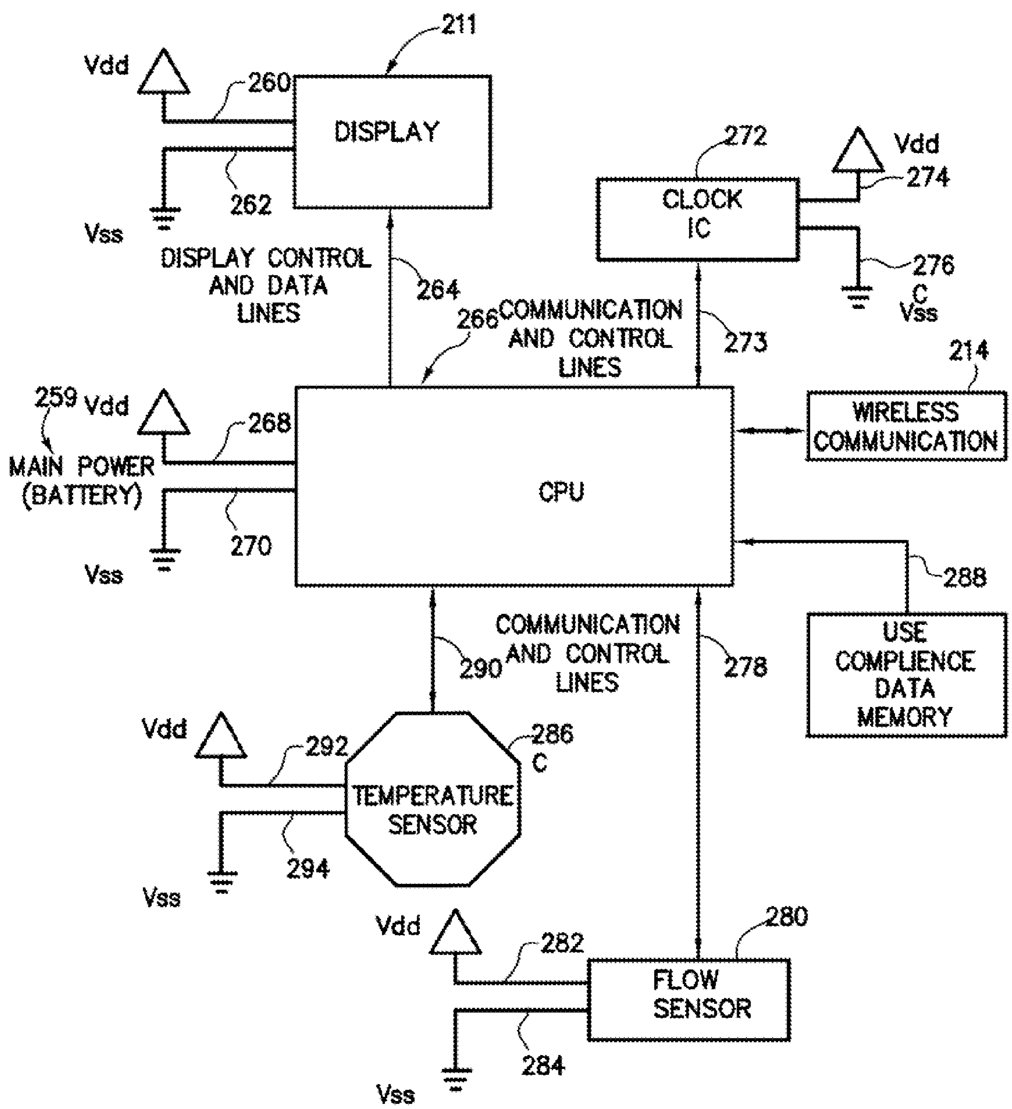


FIG. 6A

FIG. 7


211
Vdd
260
DISPLAY
262
Vss
DISPLAY CONTROL AND DATA LINES
264
272
CLOCK IC
Vdd
274
276
C
Vss
266
COMMUNICATION AND CONTROL LINES
273
214
WIRELESS COMMUNICATION
259
Vdd
MAIN POWER (BATTERY)
268
CPU
270
Vss
288
USE COMPLIENCE DATA MEMORY
COMMUNICATION AND CONTROL LINES
290
278
Vdd
292
286
C
TEMPERATURE SENSOR
294
Vss
Vdd
282
280
FLOW SENSOR
284
Vss

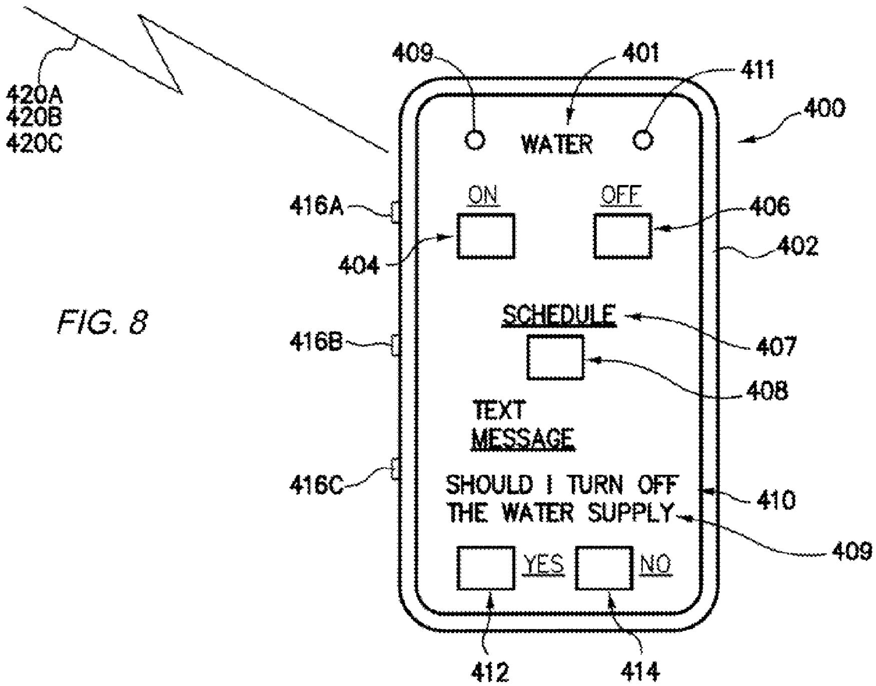

420A
420B
420C
409
401
411
400
WATER
ON
OFF
416A
406
404
402
SCHEDULE
407
416B
408
TEXT
MESSAGE
416C
SHOULD I TURN OFF
THE WATER SUPPLY
410
409
YES
NO
412
414

FIG. 8

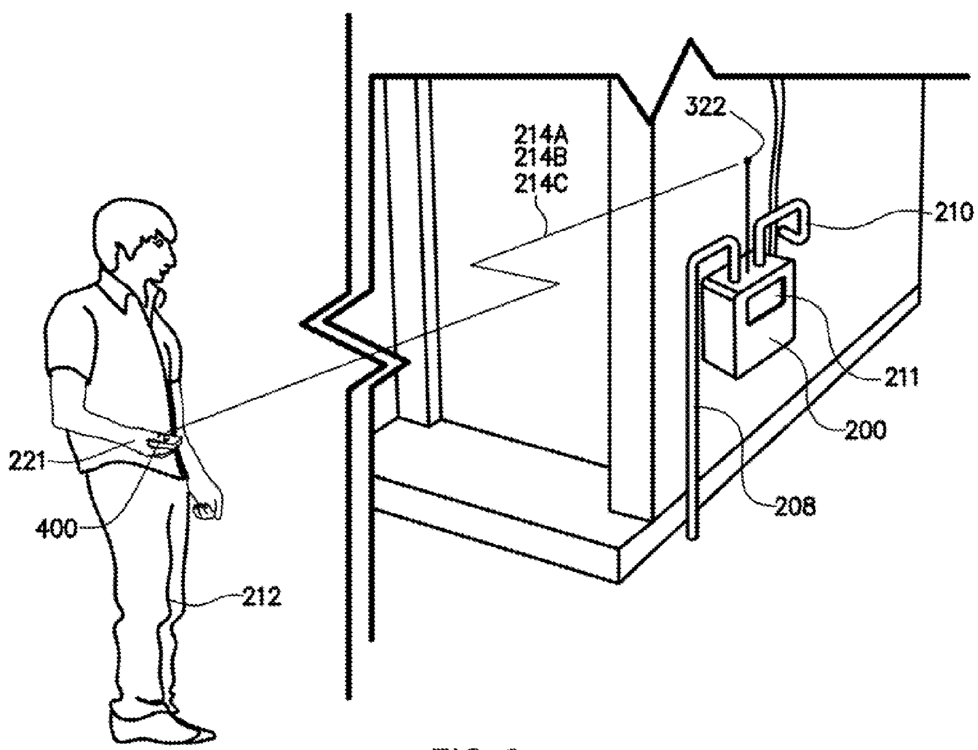
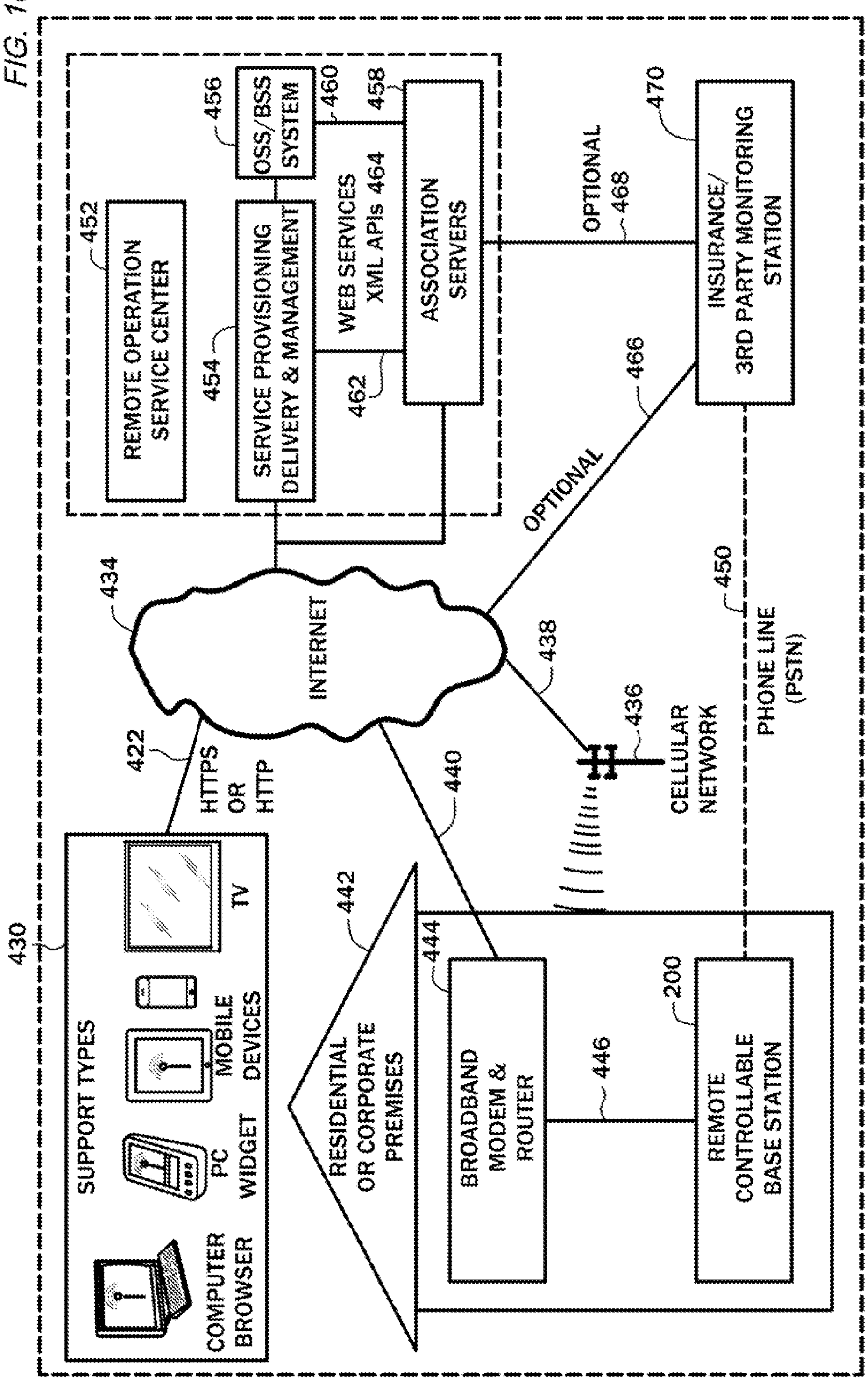

322
214A
214B
214C
210
211
200
221
208
400
212

FIG. 9


430
SUPPORT TYPES
COMPUTER BROWSER
PC WIDGET
MOBILE DEVICES
TV
422
HTTPS OR HTTP
434
INTERNET
438
436
CELLULAR NETWORK
440
442
RESIDENTIAL OR CORPORATE PREMISES
444
BROADBAND MODEM & ROUTER
446
200
REMOTE CONTROLLABLE BASE STATION
450
PHONE LINE (PSTN)
OPTIONAL
466
470
INSURANCE/ 3RD PARTY MONITORING STATION
OPTIONAL
468
452
REMOTE OPERATION SERVICE CENTER
454
SERVICE PROVISIONING DELIVERY & MANAGEMENT
456
OSS/BSS SYSTEM
460
458
WEB SERVICES XML APIs 464
462
ASSOCIATION SERVERS
FIG. 10

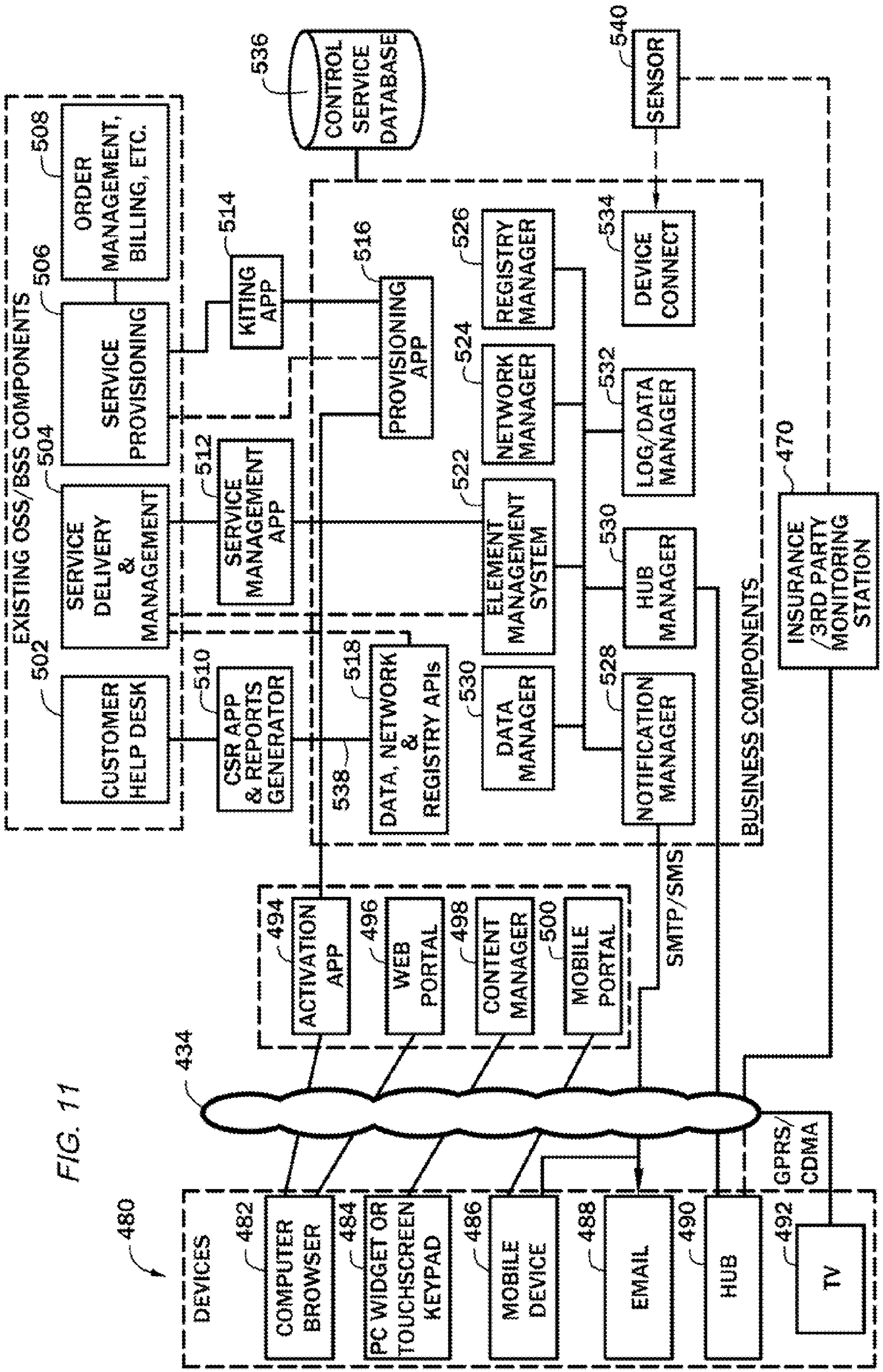
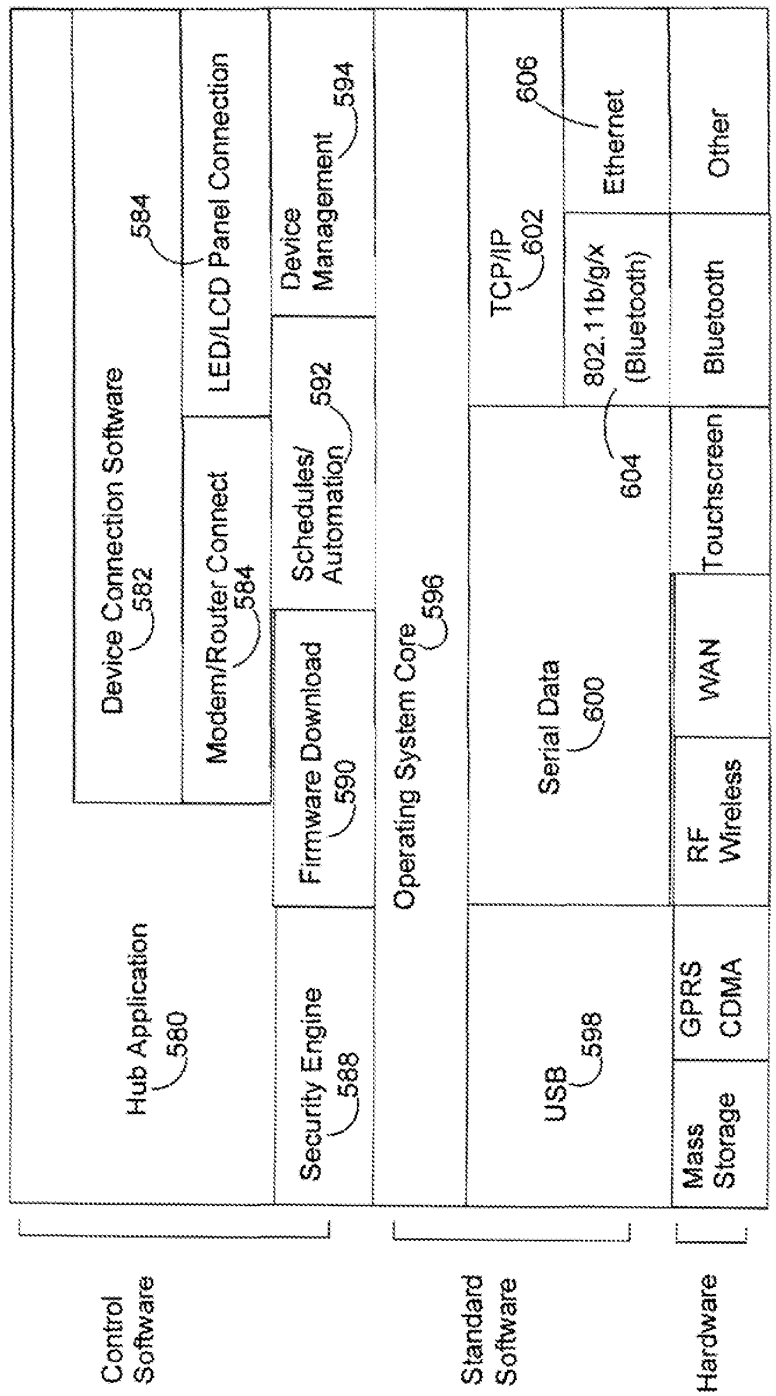

EXISTING OSS/BSS COMPONENTS
502
CUSTOMER HELP DESK
504
SERVICE DELIVERY & MANAGEMENT
506
SERVICE PROVISIONING
508
ORDER MANAGEMENT, BILLING, ETC.
510
CSR APP & REPORTS GENERATOR
512
SERVICE MANAGEMENT APP
514
KITING APP
536
CONTROL SERVICE DATABASE
540
SENSOR
538
518
DATA, NETWORK & REGISTRY APIs
516
PROVISIONING APP
530
DATA MANAGER
522
ELEMENT MANAGEMENT SYSTEM
524
NETWORK MANAGER
526
REGISTRY MANAGER
528
NOTIFICATION MANAGER
530
HUB MANAGER
532
LOG/DATA MANAGER
534
DEVICE CONNECT
BUSINESS COMPONENTS
470
INSURANCE /3RD PARTY MONITORING STATION
494
ACTIVATION APP
496
WEB PORTAL
498
CONTENT MANAGER
500
MOBILE PORTAL
SMTP/SMS
434
480
DEVICES
482
COMPUTER BROWSER
484
PC WIDGET OR TOUCHSCREEN KEYPAD
486
MOBILE DEVICE
488
EMAIL
490
HUB
492
TV
GPRS/ CDMA

FIG. 11


Hub Application 580
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Modem/Router Connect 584
LED/LCD Panel Connection 584
Security Engine 588
Firmware Download 590
Schedules/ Automation 592
Device Management 594
Operating System Core 596
USB 598
Serial Data 600
TCP/IP 602
802.11b/g/x (Bluetooth) 604
Ethernet 606
Mass Storage
GPRS CDMA
RF Wireless
WAN
Touchscreen
Bluetooth
Other
Control Software
Standard Software
Hardware

FIG. 12

WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM

RELATED APPLICATIONS

This application is a continuation-in-part of U.S. patent application Ser. No. 11/877,860 filed on Oct. 24, 2007, U.S. patent application Ser. No. 12/539,150 filed on Aug. 11, 2009, U.S. patent application Ser. No. 12/877,094 filed on Sep. 7, 2010, U.S. patent application Ser. No. 12/956,031 filed on Nov. 30, 2010, U.S. patent application Ser. No. 12/986,341 filed on Jan. 8, 2011, U.S. patent application Ser. No. 13/216,497 filed on Aug. 24, 2011, U.S. patent application Ser. No. 13/216,521 filed on Aug. 24, 2011, U.S. patent application Ser. No. 13/541,819 filed on Jul. 5, 2012 and U.S. Provisional Application 61/729,653 filed on Nov. 26, 2012. All of these applications are incorporated herein by this reference.

FIELD OF THE INVENTION

This apparatus and the method of use relates to water supplying systems. More particularly, the invention relates to a system whereby water related residential and industrial/commercial facility or building damages associated with water leakage may be reduced or eliminated by selectively disrupting the flow of water into the residence or commercial facility or building when said residence or commercial facility or building is vacated or unsupervised.

BACKGROUND OF THE INVENTION

Losses to residential property and industrial/commercial facilities owner's incident damages caused by broken water pipes are staggering. In part because broken water pipes often go undetected in the absence of the property owner or while the property owner sleeps through the night, water damage from a broken water pipe can be catastrophic. In fact, some insurance agencies report that up to seventy percent of their insurance losses are water related.

Water damages incur billions of dollars of structural, operational, reputational and financial losses each year for residential and commercial property owners. Water damage is the number one source of property claims for owners of high-rise residences, hotels, office buildings, retail establishments and other commercial structures. Leakages can create problems for property owners and managers at any time of year and during any point in a facility's life cycle. What often starts out as a small, undetected leak can quickly spread down through a building, travelling the route of least resistance and at a great distance from its original source, making detection extremely difficult.

It is therefore an object of the present invention to providing a system whereby residential property owner or an industrial/commercial owner may easily protect themselves against catastrophic damages caused by broken water pipes or leaking fixture.

Additionally, it is an object of the present invention to provide such a system that may be operated manually or automatically.

Accordingly, a need remains for a water damage prevention system that has a convenient and means facilitates a means to activate and/or deactivate the water flow from the main water supply with a high percentage of use when a residential home or industrial/commercial facility or building is vacated or unsupervised.

SUMMARY OF THE INVENTION

The present invention is a water damage prevention system that has a residential or industrial/commercial facilities water supply interruption system. The system is comprised of a remotely controllable base station with shut-off/on mechanism that is in a wireless or wired communication with a convenient remotely controller. The remotely controllable base station with shut-off/on mechanism is interposed within a water line from a water main to the living or operating quarters portion of a residential or a industrial/commercial facility or building, such that activation of the base station with shut-off/on valve operates to prevent flow of water from the water main to the living quarters when the residential home or industrial/commercial facility or building is vacated or unsupervised. In this manner, damage to the living quarters or the industrial/commercial facility or building from failure of water pipes running through the living or working quarters is prevented during times that the shut-off mechanism is activated.

To easily and conveniently activate the remotely controllable base station with shut-off/on mechanism, the remote controller preferably comprises a wireless key chain, or a wireless or wired keyboard, or a wireless or wired apparatus that is incorporated within an alarm system or a garage opening system. The remote controller is in wireless or wired communication with water base station with shut-off/on mechanism and the remote controller will have a display means to allow an individual to observe the arrangement of the shut-off/on mechanism. In this manner, occupants or owners may simply press a button on the key chain, or the keyboard, or active a alarm system, or just open and close the garage door of residential home or an industrial/commercial facility or building, causing the flow of water into the living or operating quarters to be interrupted. In a further extension of the present invention, the remote controller may also be provided with a programming timing circuit for automatically operating the base station with shut-off/on mechanism according to a defined schedule. In this embodiment, the timer may automatically cause disruption of water flow into the residential home or industrial/commercial facility or building at times that occupants or workers are normally expected to be absent, vacated, unsupervised. It is anticipated by the Applicants that the disruption of water could be activated during the night or times of resting. It is also anticipated by the Applicants that the base station with shut-off/on mechanism can be provided with an override manual valve which is operable for emergency situations.

The base station with shut-off/on mechanism can be battery operated and utilize re-chargeable batteries that could include an electricity generation means such as a water turbine generation, solar cell, or wind generation means. The base station with shut-off/on mechanism can also be AC or DC powered. It is also preferred that the key chain remote controller is powered by a battery source. The embodiments where the keyboard, alarm system or garage opener can be a combination of battery and AC/DC current power source.

Finally, many other features, objects and advantages of the present invention will be apparent to those of ordinary skill in the relevant arts, especially in light of the foregoing discussions and the following drawings, exemplary detailed description and appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the embodiment comprising a home with the base station with shut-off/on mechanism is interposed within the main water supply system and communicating wirelessly with a key chain apparatus held in the hand of an individual. The shut-off/on mechanism is shown

having a solar panel and a wind power generator connected to the mechanism to supply additional electrical power.

FIG. **2** is a perspective view of the remote controller comprising a key chain (key fob) apparatus.

FIG. **3** is a perspective view of the remote controller comprising a garage opener that is part of and communicates with the garage opening system.

FIG. **4** is a perspective view of a typical garage opening system used in residential homes.

FIG. **5** is a perspective view of a keyboard/alarm system that incorporates a means to activate and deactivate the base station with shut-off/on mechanism.

FIG. **5***a* is an enlarged view of the keyboard/alarm system that incorporates a means to activate and deactivate the base station with shut-off/on mechanism.

FIG. **6** is a schematic more detailed view of the base station with water shut-off/on mechanism and water supply plumbing with optional water turbine generator and its location within the water supply line.

FIG. **7** is an electrical schematic showing the main power, CPU or microprocessor, the analog or digital display means, the clock circuit, the temperature sensor and the flow sensor.

FIG. **8** is a perspective view of a typical cell phone, smart phone or similar apparatus having an application programmed to display soft buttons or control activators to wirelessly communicate with the base station and shut-off mechanism.

FIG. **9** is a perspective view of the embodiment comprising a home with the base station with shut-off/on mechanism is interposed within the main water supply system and communicating wirelessly with a cell phone, smart phone or similar apparatus held in the hand of an individual.

FIG. **10** is a block diagram of the more integrated system.

FIG. **11** is a block diagram of components of the more integrated system

FIG. **12** is a block diagram of the more integrated software and applications.

Corresponding reference characters indicate corresponding parts throughout the several views. The exemplifications set out herein illustrate exemplary embodiments of the invention, and such exemplifications are not to be construed as limiting the scope of the invention in any manner.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Authentication refers to the technology that ensures that a message, data, control command signal or information that is downloaded or transferred from a one person or device to another declared or intended person or device.

Encryption refers to a privacy technology that prevents anyone but the intended recipient(s) to download, review or read confidential information, signal and/or data.

Integrity refers to technology that ensures that a message, information, control command signal, and/or data do not alter in any way during transit.

Non-repudiation refers to the technology that prevents a sender from denying that a message, data, control command signal or information was sent.

Cellular format technology refers to all current and future variants, revisions and generations (e.g. third generation (3G), fourth generation (4G), fifth generation (5G) and all future generations) of Global System for Mobile Communication (GSM), General Packet Radio Service (GPSR), Code Division Multiple Access (CDMA), Evolution-Data Optimized (EV-DO), Enhanced Data Rates for GSM Evolution (EDGE), 3GSM, Digital Enhanced Cordless Telecommunications (DECT), Digital AMPS (IS-136/TDMA, Integrated Digital Enhance Network (iDEN), HSPA+, WiMAX, LTE, Flash-OFDM, HIPERMAN, WiFi, IBurst, UMTS, W-CDMA, HSPDA+HSUPA, UMTS-TDD and other formats for utilizing cell phone technology, telephony antenna distributions and/or any combinations thereof, and including the use of satellite, microwave technology, the internet, cell tower, telephony and/or public switched telephone network lines.

A typical cell phone, smart phones, or similar apparatus includes all remote cellular phones using channel access methods defined above (with cellular equipment, public switched telephone network lines, satellite, tower and mesh technology), mobile phones, PDAs, tablets (e.g. refers to all current and future variants, revisions and generations of the Apple IPAD, Samsung Galaxy, HP, Acer, Microsoft, Nook, Google Nexus, Sony, Kindle and all future tablets manufactured by these and other manufacturers), Apple IPOD Touch, or a television, watch, timepiece or fob watch and other similar apparatus with WIFI and wireless capability, and remote computers and controllers having internet or wireless connectivity.

Referring now to the drawings and particularly to FIG. **1**, the water damage prevention system of the present invention generally comprises a remotely controllable base station **200** with water shut-off/on mechanism **310** strategically located between a main supply line **208** from a water main and a household water supply line **210** to a residential building **202**. The remotely controllable base station with water shut-off/on mechanism is activated and deactivated by a remote controller **220** to selectively turn on and off the water through the household water supply line **210**. In the preferred embodiment of the present invention, the remotely controllable base station **200** with water shut-off/on mechanism **310** is located with respect to the household water supply line **208** such that water flow through the household water supply line **210** to the living quarters of the residential building **202** may be prevented while still allowing water flow to non-residential areas, such as to sprinkler lines. It is also anticipated by the Applicants that the remotely controllable base station **200** with water shut-off/on mechanism **310** can take the place of, and function as, the pressure reduction valve. FIG. **1** also shows the remotely controllable base station **200** with water shut-off/on mechanism **310** connected with a wired means **205** from a solar electrical generation **204** and/or connected with a wired means **207** from a wind electrical generation **206**. In this regard, the remotely controllable base station **200** with shut-off/on mechanism **210** can be battery operated and utilize re-chargeable batteries or have typical batteries that are replaceable. The remotely controllable base station **200** with shut-off/on mechanism **310** can also be AC or DC powered. An antenna **322** is shown extending from the remotely controllable base station with water shut-off/on mechanism.

The housing for the remotely controllable base station **200** (with water shut-off/on mechanism **310**) can be fabricated from a metallic material such as metallic alloys, steel, galvanized steel, aluminum or any combination thereof. The housing for the remotely controllable base station **200** (with water shut-off/on mechanism **310**) can be fabricated can be also fabricated from a number of polymeric materials, such as polyvinyl chloride (PVC), polyethylene, polybutylene, acryaontirile-butadiene-styrene (ABS), rubber modified styrene, polypropylene, polyacetal, polyethylene, or nylon. The base material can be painted white or colored finishes or coated with various brass, silver and gold type materials to accommodate the match with various presently marketed finishes.

The joint between the water supply lines **208** and **210** and the remotely controllable base station **200** with water shut-off/on mechanism **310** could be screw and thread fitting, compression fitting, flare fitting, solder, brazed, or sweat joint, adhesive technology and/or use typical plumbing techniques. The joint may be designed to be permanent or removable. The remotely controllable base station **200** can incorporate a freeze design feature (not shown) which, before a freezing condition is encountered, activates a freezing mechanism. This technology is commonly called "frost plugs" or "freeze plugs". This protects the more expensive remotely controllable base station **200** by sacrificing the less expensive and easy to install frost/freeze plug. The optional frost/freeze plug technology is typically used in outside underground pits or poorly heated garages or utility rooms. In some extraordinary freezing situations, the optional frost/freeze plug can be incorporated with a draining mechanism or system (not shown) that allows the water to passively drain from the home or business water pipes or forcefully removes the water from the water pipes with a power system. And it is anticipated that in these extraordinary freezing situations, the draining mechanism or system can also replace the water in the water pipes with air, nitrogen or other gas/liquid that have low freezing points and non-toxic conditions, are can withstand the freezing conditions to minimize damage to the water pipes.

The remotely controllable base station **200** with water shut-off/on mechanism **310** can include a display means **211** for displaying various information, such as if the water is interrupted or allowed to flow into the residence or industrial/commercial facility or building, or to help program the software for scheduled water interruption times (off from 8:30 a.m. until 4:30 p.m. then on, off again at 11:00 p.m. until 5:00 a.m. and then on again). The display means **211** can help program the software to display calendar information, such as the date and current time (12 hr. or 24 hr. format). In this regard, the remotely controllable base station **200** can be programmed using a wire or wireless remote keyboard, alarm system, or use touch screen button technology on the display. The display utilizes one or more illuminating technologies, such as LCD, LED, gas plasma, fluorescence, incandescent, halogen, halide, or other lighting technologies but must able to provide sufficient lighting for observing the data in low light conditions. In addition, the display means and display means housing must be able to sustain capability in outdoor wet and/or hot conditions. The display **211** can have a background light that is used for various purposes, for example, for providing better lighting conditions or changing color e.g. from green to red, to display an alarming condition. An example of a LCD unit that can be used with the present invention is the color graphic 128×128 LCD-00569 marketed by Sparkfun Electronics in Boulder, Colo. It is anticipated by the Applicants that there are other variants and other LCD, LED, gas plasma, fluorescence, incandescent, halogen, halide, or other lighting technologies that can be utilized with the present invention. The display can utilize touch screen technology.

One of the key features of the present invention water damage prevention system is that it has a convenient and easy means which facilitates activation and/or deactivation of the water flow from the main water supply with a high percentage of use when a residential home or industrial/commercial facility or building becomes vacated or unsupervised. If a non-convenient means is utilized, the ratio of use will decrease which compromises the design goal of the present invention. In this regard, shown in FIG. **1** is an individual **212** holding a remote wireless key chain or key fob apparatus **220** in his hand **221**. Generally one carries one or more key chains or key fobs for holding keys for entry of one's residence or office, car operation etc. The remote wireless key chain or key fob apparatus **220** communicates wirelessly with the remotely controllable base station **200** with water shut-off/on mechanism **310** with a wireless means **214**. Another embodiment of the present invention show a programmable alarm keyboard **218** as part of an overall residential or commercial alarm system for communicating with the remotely controllable base station **200**. Another embodiment of the present invention, shown later, includes a specific garage door opener for communicating with the remotely controllable base station **200**. Another embodiment of the present invention, also shown later, includes a cell phone, smart phones, or similar apparatus **400** for communicating with the remotely controllable base station **200**.

The wireless means **214** can use radio-frequency, Bluetooth, WiFi, Zigbee, optical or other wireless technology for communicating with the remotely controllable water shut-off/on mechanism **200**. Examples of Bluetooth modules (using the 2.4 GHz band as WiFi) that can be added to the present invention are the RN-41 Bluetooth modules available from Roving Networks in Los Gatos, Calif., the KC-41, KC 11.4, KC-5100, KC-216 or KC-225 data serial modules from KC Wireless in Tempe Ariz., and/or the BT-21 module from Amp'ed RF wireless solutions in San Jose, Calif. Examples of wireless protocols that can be utilized with the present invention include, but are not limited to, the IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and IEEE 802.11n modulation techniques. Applicants recognize that there are numerous wireless protocols that have been developed that, although not specifically listed, could be utilized with the present invention for data transfer purposes.

ISM bands defined by the ITU-R are:

Frequency range [Hz]	Center frequency [Hz]	Availability
6.765-6.795 MHz	6.780 MHz	Subject to local acceptance
13.553-13.567 MHz	13.560 MHz	
26.957-27.283 MHz	27.120 MHz	
40.66-40.70 MHz	40.68 MHz	
433.05-434.79 MHz	433.92 MHz	Region 1 only
902-928 MHz	915 MHz	Region 2 only
2.400-2.500 GHz	2.450 GHz	
5.725-5.875 GHz	5.800 GHz	
24-24.25 GHz	24.125 GHz	
61-61.5 GHz	61.25 GHz	Subject to local acceptance
122-123 GHz	122.5 GHz	Subject to local acceptance
244-246 GHz	245 GHz	Subject to local acceptance

While currently the 430 MHz, 900 MHz and 2.4 GHz and 5 GHz frequencies are commonly used in the US, it is anticipated by the Applicants that the other frequencies could be used for signal and data transfers.

Another protocol known as CAN or CAN-bus (ISO 11898-1) was originally designed for automotive applications, but is now used in industrial applications. CAN is another type of network that can be used to transfer water parameter data. Devices that are connected by a CAN network are typically sensors, actuators and control devices. A CAN message never reaches these devices directly, but instead a host-processor and a CAN Controller is used between these devices and the bus.

Now referring to FIG. **2** which is a perspective view of the remote controller comprising a key chain or key fob apparatus **220**. The remote controller key chain or key fob apparatus **220** is of a convenient size for placing in a pocket or purse and has

a chain connection **224** for attached one or more keys **222**. The main housing **226** of the key chain or key fob apparatus **220** has a pair of buttons. One button **228** activates the base station **200** with water shut-off/on mechanism **310** through wireless communication **114** interrupting or activates the water supply to the residence **216** or industrial/commercial building. The other button **230** deactivates the remotely controllable base station water **200** with shut-off/on mechanism **310** to turn on the water supply. It is anticipated by the Applicants that one button can be utilized to activate and deactivate means (toggle on and off). An indicator LED, LCD or other light (or display) can show the state of the shut-off/on mechanism, e.g. green for open (deactivated) and red for closed (activated). In addition, an auditory alarm can be incorporated into the present invention for the purposes of relating the state of the shut-off/on mechanism e.g. one beep for on and two beeps for off. The remote controller key chain or key fob apparatus **220** also has, but is not shown, an internal replaceable or rechargeable battery with an operable battery door, electrical circuitry, and transceiver with internal antenna. The wireless communication means could use utilize encryption, authentic, integrity and/or non-repudiate techniques to provide a secure signal (with pairing technology) so that the activation or deactivation occurs with integrity and accuracy such that that is not conflict with other wireless signals or technology in the immediate area. Also, with residences and industrial/commercial buildings in close proximity, it is essential that the signal only activates or deactivates the intended and specific remotely controllable base station **200** with water shut-off/on mechanism **310**. Such technology will ensure that the signal is secure such that unintended or intended signals do not send control messages to non-desired or non-owned base stations **200** with water shut-off/on mechanisms **310**.

FIG. **3** shows a garage door opener **240** that is part of an overall garage door **250** opening system **252** with chain or cable driving mechanism **254**. The garage door opener is typical in size and function with a button **244** for opening and closing the garage door. The difference is that the garage door opener has additional buttons. One button **228** activates the base station water **200** with shut-off/on mechanism **310** through wireless communication **114**, interrupting the water supply to the residence **216** or industrial/commercial building. The other button **230** deactivates the remotely controllable base station **200** with water shut-off/on mechanism **310** to turn on the water supply. It is anticipated by the Applicants that one button can be utilized to activate and deactivate means (toggle on and off). An indicator LED, LCD or other light (or display) can show the state of the shut-off/on mechanism, e.g. green for open and red for closed. In addition, an auditory alarm can be incorporated into the present invention for the purposes of relating the state of the shut-off/on mechanism. It is anticipated that new garage door opening systems **252** can incorporate the components necessary to communicate wirelessly or hard wired to communicate with the remotely controllable base station **200** with water shut-off/on mechanism **310** of the water damage prevention system. In previously installed garage door opening systems, a specifically designed electrical module can be electrically attached to the previously install garage door opening system that works with a new garage door opener **240**. The wireless communication means could use utilize encryption, authentic, integrity and/or non-repudiate techniques to provide a secure signal (with pairing technology) so that the activation or deactivation occurs with integrity and accuracy such that that is not conflict with other wireless signals or technology in the immediate area. Also, with residences and industrial/commercial buildings in close proximity, it is essential that the signal only activates or deactivates the intended and specific remotely controllable base station **200** with water shut-off/on mechanism **310**. Such technology will ensure that the signal is secure such that unintended or intended signals do not send control messages to non-desired or non-owned base stations **200** with water shut-off/on mechanisms **310**.

FIG. **4** is a perspective view of a typical garage opening system. The typical garage door opening system has a distal means to attached to the garage door **250** the engages a chain, belt or screw drive mechanism **254** that is operated by a proximal housing **252** that contains an electric motor, lights, timing circuits, and wireless communication technology. Near the garage door shown is an alarm keypad **218** as discussed in more detail in the paragraph below.

FIG. **5***a* shows an alarm keyboard **218** that is part of an overall alarm system, whereas FIG. **5***b* show an enlarged view of the alarm keyboard. One or more alarm keyboards **218** are typically located within the living quarters of the residential or commercial building adjacent an entry doorway. In this embodiment, specific coding of the alarm system will be necessary. By pushing specific keys on the keyboard (hard or soft keys) **256** will be utilized to not only input alarm codes, but also to activate and deactivate the remotely controllable base station **200** with water shut-off/on means **310**. In one operation, when one arms the alarm system, after the delay, the alarm system will become activated and the alarm system can communicate wirelessly or by hard wired with the remotely controllable base station **200** with water shut-off/on mechanism **310**. In another operation, a specific step, key code or question will be necessary in the alarm programming to include an intended response before the corresponding wireless or hard wired signal is sent to the remotely controllable base station **200** with water shut-off/on mechanism **310**. This may be a necessary step as some individuals use the alarm system (peripheral surveillance) when they are in their homes for additional protection. It is anticipated that new alarm systems can incorporate the software instruction and components necessary to communicate wirelessly or hard wired to communicate with the remotely controllable base station **200** with water shut-off/on mechanism **310** of the water damage prevention system. In previously installed alarm systems, a specifically designed electrical module may be electrically attached to the previously install alarm system. The wireless communication means will preferably utilize encryption, authentic, integrity and/or non-repudiate techniques to provide a secure signal so that the activation or deactivation occurs with integrity and accuracy such that that is not conflict with other wireless signals or technology in the immediate area. Also, with residences and industrial/commercial buildings in close proximity, it is essential that the signal only activates or deactivates the intended and specific base station with water shut-off/on mechanism. Such technology will ensure that the signal is secure such that unintended or intended signals do not send control messages to non-desired or non-owned base stations **200** with water shut-off/on mechanisms **310**. It is anticipated by the Applicant that in hotels and motels situations, the alarm system or key entry or electrical door card placed within an electrical receptacle can activate the remote controllable base station to turn off the water when the hotel/motel room is unoccupied (and activates remote controllable base station to the turns on the water when the hotel/motel room is occupied.

An option to be utilized with the present invention is that the remotely controllable base station **200** with water shut-off/on mechanism **310** can include programming instructions with a timing circuit to a user defined time schedule. In this

manner, the residential occupant or industrial/commercial owner may simply establish that the water supply will be blocked during working hours and/or during sleeping hours. The scheduling could be a daily, weekly, monthly or annual. The programming of the timing schedule could be input into the CPU of the base station electrical circuitry via various methods, e.g. wireless or wired communication with a computer with appropriate software, using the remote controllers, or using touch screen technology on the display means, etc.

Now referring to FIG. **6**, shown is a perspective more detailed view of the remotely controllable base station **200** with water shut-off/on mechanism **310** and water supply plumbing, and with optional water turbine generator **308** that is located within the water supply line. The water supply line from the water main **208** first engages a manual shut off valve **302**. The manual shut off valve can be a ball valve, gate value type, piston valve, or other known technology. Further along the water supply line is a pressure regulator **304** with a connecting pipe **306** to the present invention water damage prevention system remotely controllable base station **200** with water shut-off/on mechanism **310**. Also shown is an optional water turbine generator **308** that could be utilized to produce electrical energy for recharging the battery source **326**. The water shut-off/on mechanism **310** (shown as solenoid shutoff valve) can be a ball valve, gate value type, piston valve, or other known technology with electronic activation. A mechanical lever **311** can be incorporated on the water shut-off/on mechanism (solenoid shutoff valve) to allow the modification of the mechanism to open the water flow in emergency and necessary situations. The remotely controllable base station **200** has a transceiver **320** that includes an antenna **322** which can be external or internal. The control circuit for the remotely controllable base station **200**, shown in more detail in FIG. **7**, includes programmable CPU, a power source using either a battery (rechargeable) **326** or typical AC or DC supply **324**, and electrical circuitry, wireless or hard wired components, and optional sensors and associated circuitry. Also shown is a battery voltage **326** which would electronically engage the optional solar cell **302** or wind generator **206** to provide additional electrical energy. Exiting from the remotely controllable base station **200** with water shut-off/on mechanism **310** is the main water supply **312** to the home (or commercial facility or building). It is anticipated by the Applicants that the water shut-off/on mechanism **311** (solenoid or ball valve shutoff valve), and if used, the optional water turbine generator **308**, could be incorporated within the remotely controllable base station **200** as a single unit.

It is also anticipated that the remotely controllable base station **200** with water shut-off/on valve **310** could replace, and function as, the main water meter.

Multi-jet meters measure water velocity converting the velocity into volume of use. They use an impeller which rotates on a horizontal plane that is driven by several "jets" of water flowing through holes evenly spaced around the entire circumference of the impeller. Strong points of multi-jet meters are that they can be smaller than PD meters of the same flow rate, and therefore sometimes less expensive and lighter weight reducing manufacturing and shipping costs. Multi-jets are very accurate at low flow rates, and have low head loss (pressure loss) at high rate compared to PD meters. Since the impeller moves freely in the chamber on a spindle with a bearing, it can also pass sand, rust particles, minerals, or small particulate matter without damage or clogging. In this embodiment, a Multi-jet meter can incorporate a stop mechanism such as a solenoid activated mechanism (not shown) that impedes the impeller from rotating and restricts the flow of water. Such activated mechanism can be wirelessly (or wired) controlled remotely as described herein.

Positive Displacement Meter or "PD" meters measure water volume with an oscillating piston or a nutating disc. PD meter sizes are typically ⅝" to 2". The disc or piston has very high tolerances between it and the chamber. Water must push or "displace" the measuring element to go through the meter. Because of high tolerances, new and well maintained PD meters can be very accurate. PD meters can have more pressure loss through the meter and be somewhat noisier in indoor settings at high flow rates than multi-jet meters. PD meters cannot be recalibrated, but must be rebuilt with new measuring chambers when they wear out. Because water cannot pass through the meter without moving the measuring element, they are good candidate for incorporating a stop mechanism such as a solenoid activated mechanism or pin (not shown) that impedes the oscillating piston or nutating disc from operating and restricts the flow of water. Such activated mechanism can be wirelessly (or wired) controlled remotely as described herein.

Single jet meters are another standard meter specification less common in the U.S. Single Jets are sometimes called "paddle wheel" meters. Single jets have an off center inlet and outlet and a jet of water flows on only one side of an impeller, working similar to the water wheel at an old mill or the paddle wheel on a riverboat. Because water cannot pass through the meter without moving the measuring element, they may be a good candidate for incorporating a stop mechanism such as a solenoid activated mechanism or pin (not shown) that impedes the "paddle wheel" from rotating and restricting the flow of water. Such activated mechanism can be wirelessly (or wired) controlled remotely as described herein.

Shown in FIG. **7** is a more detailed description of the electrical circuitry. A timing clock integrated circuit **272** with data transfer means **273** for communicating with the CPU or microprocessor **266** and having a power line **274** and ground line **276**. The timing sensor can communicate with the CPU or microprocessor to display such information such as the time of day and current date and/or the totally duration that the water supply has been on before it was turned off, or for providing scheduling procedures. Various mechanical and magnetic switches can be utilized to communicate a signal to the CPU or microprocessor **84** that water supply has been turned off and on.

The CPU or microprocessor **266** that processes the control signals supplied by the remote controllers **218**, **220** and **244**, the timing circuitry **272**, and the optional temperature **286** and flow sensors **280** uses internal instructions to control the information projected on the remote controllers **218**, **220** and **244** and optional display **211**. The microprocessor can include an EEPROM or any type of memory section that allows for specific programming to be incorporated as processing instructions (e.g. scheduling). Furthermore, the microprocessor may have the capability to convert analog signals into digital information for decoding and processing. An example of a CPU or microprocessor **266** that could be used for the CPU or microprocessor is the PIC16F876 28-pin 8-Bin CMOS FLASH micro-controllers manufactured by Microchip Technology, Inc. This particular microprocessor has a 128K EEPROM Data memory bank for flash memory of specific instructions and utilizes a 35-word instruction set. It also has five 10-bit Analog-to-Digital Inputs that can provide the means for converting the information obtained from the optional temperature sensor **286** and flow sensor **280** from analog format into a digitized form for processing by the instruction sets of the CPU or microprocessor **266**. Another example of a microprocessor that could be used for the CPU

or microprocessor **266** is the MSP430 family of processors from Texas Instruments in Dallas, Tex. There are hundreds of variants but for an example, the MSP430F436IPN (80 pin package) or MSP430F436IPZ (100 pin package) could be utilized in the present invention. There are many other variants or other microprocessors, whether commercially marketed or privately fabricated, that can be used with the present invention.

The CPU will could also have the capability to record compliance use data, e.g. time and date stamp for recording each water system shut off or turn on occurrence. The compliance use data can be used by insurance companies, municipality agencies, third parties, or the owner of a residence or company, to determine if the individuals are utilizing the water damage prevention technology or if a during a particular leak damage event that the water prevention technology was utilized. The compliance use data can be downloaded by a USB or other transfer port or transferred wirelessly (or by PSTN) to a support type device, the remote managing operations, or the insurance company, municipality agency or a third party. The use of the data obtained can be presented in various formats or defined formats specified by owner, insurance companies, municipality agencies or third party.

The wireless communication means **214** communicates with the programmable CPU **266** through data lines **277**. The programmable CPU or microprocessor **266** receives electrical energy through power line **268** and a ground line **270**. The optional display **211** communicates with the CPU or microprocessor **266** with display control and data lines **264**. If utilized, the display **211** receives electrical energy through power line **260** and a ground line **262**.

An optional temperature sensor **286** can be incorporated in the remotely controllable base station **200** to monitor water temperature. The temperature sensor **286** can be used to sense freezing conditions which might disrupt proper operation of the system, can be utilized to provide more accuracy of other components, such as the flow sensor, or active a freeze plug mechanism. In some extraordinary freezing situations, the optional temperature sensor **286** can be incorporated with a draining mechanism or system (not shown) that allows the water to passively drain from the home or business water pipes or forcefully removes the water from the water pipes with a power system. And it is anticipated that in these extraordinary freezing situations, the draining mechanism or system can also replace the water in the water pipes with air, nitrogen or other gas/liquid that have low freezing points and non-toxic conditions, are can withstand the freezing conditions to minimize damage to the water pipes.

The optional temperature sensor **286** receives electrical energy through power line **292** and a ground line **294**. The optional temperature sensor **286** can function to automatically shut off the water when the temperature approaches freezing or transfer temperature data wirelessly to warn of the freezing conditions and allow an individual to make the decision to send wireless instructions from the keychain or key fob apparatus **220**, garage door opener **240**, alarm system **218**, or cell phone, smart phone or similar apparatus **400**.

In addition, in another embodiment the remotely controllable base station **200** could communicate with optional highly sensitive flow sensors with transceivers that are designed to determine if the flow is occurring through a particular water fixture is as slow as, for example, 25-50 ml per minute. The highly sensitive flow sensors with transceivers can be programmed to periodically detect slow flow or no flow conditions at particular time intervals, such as, for example, every 10 to 45 seconds. Alternately the water parameter data can be recorded and stored at individual high flow sensor for subsequent transmission as a stream of data points or a data packet. In this regard the recorded data can be transmitted wirelessly to the remotely controllable base station **200** at longer programmable time intervals, such as, for example, every 24 hours. The highly sensitive flow sensor with transceivers are designed as wireless flow sensors and designed to have very low electrical power usage. Power consumption for each highly sensitive water flow sensor with transceivers are designed to be extremely low, for example, about 100-200 micro-amp hours per day. Power can be supplied by batteries, or alternatively, can be connected to the 120/240 volt electrical system. The highly sensitive water flow sensors with transceivers can have an extended battery life by utilizing the interval wireless communications or transmissions and with a long lasting battery pack, such as, for example, the Tadiran series of batteries manufactured by Tadiran U.S. Battery in Lake Success, N.Y. A sealed door means is utilized to allow battery replacement. In addition, the batteries can be recharging type and accessed with an electrical coupler accessed from the outside of the highly sensitive flow sensors with transceivers.

At the water use and water energy use monitoring display apparatus/base station **10**, **126**, received data can be stored and analyzed to determine whether any water fixture in the facility is leaking by analyzing a means that differentiates between normal flow conditions and a slow flow condition When or if leakage condition is indicated, an alert can be generated on the various displays associated with the remotely controllable base station **200** and/or initiate a call, using wireless network **44**, can be made to the home or office owner/operator or to the municipality or governing agency (or an insurance company) so that maintenance personnel can be dispatched to turn-off the water supply at the offending residence or office or fix the leaking unit. The data and/or results of analysis conducted at the remotely controllable base station **200** can be transmitted to a remote central monitoring computer service via satellite, microwave technology, the Internet, telephone lines, and the like. At the off-site location, additional analysis and/or monitoring can be accomplished.

The highly sensitive flow sensors with transceivers, are designed to have coordination, between the remotely controllable base station **200** by using software instructions for timing, network position, and polling operations. For example, the base station **200** can first send a broadcast message to, for example, one or more highly sensitive flow sensors with transceivers The broadcast message can instruct the highly sensitive flow sensors with transceivers to, for example, synchronize themselves in the system, set their clocks, and identify their wireless path to the remotely controllable base station **200**. After receiving the broadcast message, the remotely controllable base station **200** can send an acknowledgement back to the base station **200** revealing their location in the system.

The remotely controllable base station **200** can also communicate with the highly sensitive flow sensors with transceivers to include software instructions for programming time intervals for water parameter data transmission.

Coordination of data packet transmissions from the highly sensitive flow sensors can be scheduled. The remotely controllable base station **200** can run a master schedule for querying each flow sensor. For example, remotely controllable base station **200** can transmit a message to a specific coordinator node **18** and that coordinator node can then sequentially request data from each of its flow sensors. This systematic process can reduce data packet collision on the network and can make the remotely controllable base station **200** imme-

diately aware of any flow sensor that might be having trouble transmitting its data packet. The remotely controllable base station **200** can transmit an acknowledgement to each highly sensitive flow sensors after successfully processing a data packet.

The software in the remotely controllable base station **200** to perceive water flow characteristics in the facility for a given unit of time, such as, for example, a day, for every unit in the facility. The software should be designed to identify numerous conditions, such as, for example, faulty toilet valves, periodic and irregular water flow for example toilets, faucets, and a slow constant water flow, a characteristic of a leakage condition.

Referring to FIG. **8**, which shows a perspective view of a typical cell phone, smart phones, or similar apparatus **400** having an application **402**, commonly known as an "APP", programmed to display soft buttons or use control activators on a cell phone, smart phone, or similar apparatus **400**, designed to wirelessly communicate or send signals to and from the remotely controllable base station **200** with water shut-off/on mechanism **310**. It is also anticipated that the apparatus **400** could be an Apple IPAD, HP, Samsung, LG, or other manufacturer's tablet and that the application **402** that would function as described below. Furthermore, apparatus **400** could be a remote computer or television that is connected to the internet or has wireless capability. Shown in FIG. **8** is an example of an application **402** which will typically display soft buttons for controlling water on **404** and water off **406** by sending wireless instructions to the remotely controllable base station **200**. It is anticipated by the Applicant that other configuration of application displays for remotely communicating with a remotely controllable base station **200**. The application **402** can also have a soft schedule button **408** which sequentially adds displays for entering a predetermined schedule for turning on and off the water at the remotely controllable base station **200**. The predetermined schedule can be sent to the remotely controllable base station **200** for continuous sequencing operations on a: daily, weekly, monthly or yearly basis. The predetermined schedule can be stored in a memory module at the remotely controllable base station **200**.

An option of the application **402** is shown as a decisional text message **410** inquiring if the individual would like the water turned off sent to the cell phone, smart phone or similar apparatus **400**. The cell phone, smart phone or similar apparatus **400** would preferably have incorporated GPS technology that can determine the location of the cell phone, smart phone or similar apparatus, and know or saved the home or remotely controllable base station **200** location. Triangulation techniques between cell towers can also be used if the cell phone, smart phone or similar apparatus **400** does not have GPS capability. The application **402** could or will have a routine that can program the distance from the remotely controllable base station **200** that an individual wants to be provided a notice of the decisional text message. If the water is not turned off when the individual leaves the residence or business, and the cell phone, smart phone or similar apparatus **400** has been programmed for a set distance from the base station e.g. ¼ mile, then the decisional text message **410**, for example. "Should I turn off the water supply", will be sent to the cell phone, smart phone or similar apparatus **400**. The rational for the decisional text message is that, for the present invention to function as a water damage prevention system, substantial compliance with routine turning off the water when a home or business in unoccupied is necessary. The decisional text message **410** provides the individual a soft button "yes" **412** to turn off the water at the remotely controllable base station **200** or "no" **414** and leave the base station **200** with the water control valve on. Hard button activators **416***a*, **416***b* and **416***c* can also be used to communicate with the remotely controllable base station **200** for cell phones, smart phones or a similar apparatus that a limited display screens or no touch screen capability. For example, hard button **416***a* can communication with the remotely controllable base station **200** to turn the water system on, hard button **416***b* can communication with the remotely controllable base station **200** to turn the water system off, and hard button **416***c* can communication with the base station to open a schedule page.

Another optional decisional text message **410** can sent to the cell phone, smart phone or similar apparatus **400** if one of the optional highly sensitive flow sensors detects a leaking condition. The text message could specify "Leak found in kitchen area, should I turn of the water supply". The decisional text message **410** provides the individual a soft button "yes" **412** to turn off the water at the remotely controllable base station **200** or "no" **414** and leave the remotely controllable base station **200** with the water control valve on. Hard button activators **416***a*, **416***b* and **416***c* can also be used to communicate with the base station for cell phones, smart phones or a similar apparatus that a limited display screens or no touch screen capability. This optional leak detection message could also be sent the insurance or municipality agency monitoring station by PSTN or wireless means to notify of the leakage condition. It is also anticipated by the Applicant that the leak detection message could also be transferred to the supplying municipality to inform them of the leak such that the municipality can take action to repair the leak condition.

Also shown in FIG. **8** are one or more visual signals **409**, **411** (e.g. LED or LCD) lights that are turned on (and off after a period of time) to communicate to an individual that the remotely controllable base station **200** has completed the programmed activity. For example only, **409** could be a red LED light that illuminates when the water system is turned off and **411** could be a green LED light that illuminates when the water system is turned on. It is anticipated by the Applicant that verbal signal (verbal "water off" or verbal "water on" or simply a playing certain ringtones) can also be used to communicate that the programmed activity has been completed.

Typical cell phones, smart phones, and similar apparatuses **400** may have one or more means of communication that can be established with a particular remotely controllable base station **200** for wireless communication. The use of Bluetooth wireless technology **420***a* is commonly a feature found on many cells phones, smart phones and similar apparatus. Such Bluetooth wireless communication **420***a* can be a means to communicate with the remotely controllable base station **200** with water shut-off/on mechanism **310** to turn the water on or off or receive decisional text messages **410**. Zigbee is another wireless technology that can be used. However, most current cell phones, smart phones or similar apparatus **400** do not possess Zigbee wireless capability.

The use of WIFI (IEEE 802.11 family of wireless local area network) wireless technology **420***b* is commonly a feature found on many cells phones, smart phones and similar apparatus **400**. Such WIFI wireless communication **420***b* can be a means to communicate remotely with the remotely controllable base station **200** with water shut-off/on mechanism **310** to turn the water on or off or receive text messages. The remotely controllable base station **200** can have the capability to receive and transfer wireless signals and decisional text messages **410** using WIFI technology directly to the remotely controllable base station **200**. Alternately, the WIFI communication **420***b* will communicate with a wireless router that

has a HTML based interface and configuration page graphic user interface. Remote access from the cell phone, smart phone or similar apparatus **400** could use a short message service (SMS) interface and/or voice of Internet Protocol (VOIP) which communicates with the wireless router. This WIFI technology will access the internet and have the ability to recognize the cell phone, smart phone or similar apparatus **400** phone number for remote capability using SMS interface. A digit numbers security can be used to maintain restricted integrity. Wireless Transmitters and Receivers can be used for WIFI communication **420***b* to the remotely controllable base station **200** for individuals lacking internet capability at their residence.

The use of cellular wireless technology **420***c* is a primary feature of cells phones, smart phones and similar apparatus. Such cellular wireless communication **420***c* can be a means to communicate with the remotely controllable base station **200** with water shut-off/on mechanism **310** to turn the water on or off or to receive text messages.

The application **402** will have to interface with the Bluetooth **420***a*, WIFI **420***b*, or cellular **420***c* wireless communication means, and send instructions to a specific "paired" remotely controllable base station **200**. Various pairing methods between the remotely controllable base station **200** and the cell phone, smart phone or similar apparatus **400** are contemplated to be necessary to ensure that proper communication is established between a single and unique remotely controllable base station **200** in addition to one or more unique cell phone, smart phone or similar apparatus **400**. A Quick Response Code (QR code) unit address located on remotely controllable base station **200** can communicate with a cell phone, smart phone or similar apparatus **400** having a camera to read QR and establish link to the remotely controllable base station **200**. Standard barcodes could would to pair and establish a link between the remotely controllable base station **200** and the cell phone, smart phone or similar apparatus **400**. Near field link and RFID chip technology can also be used to facilitate pairing and establish a link between the remotely controllable base station **200** and the cell phone, smart phone or similar apparatus **400**. Currently bar code readers are applications that can be downloaded for a particular cell phone, smart phone or similar apparatus operation system. Near field links are only recently becoming available on Samsung smart phones, but this technology may be expanded to many, if not all, cell phones, smart phones or similar apparatus.

In operation, an individual who wants to turn off the water system would touch the off the soft button **406** or reply to the text message to turn off the water system **410** "yes" soft button **412**, or push the hard button **416***b* on the a cell phone, smart phone or similar apparatus **400** which will communication with the remotely controllable base station **200** via the internet, wireless technology (e.g. Bluetooth, Zigbee), and/or cellular format technology and then the paired remotely controllable base station **200** would turn off the water system off and then when completed (specified by switches and/or a flow sensor) will send a returned communication signal to the a cell phone, smart phone or similar apparatus **400** and turn on signal (audio or visual) message **409** that the water system is off. Comparable, an individual who wants to turn on the water system would touch the "on" the soft button **404** or reply to the text message to turn off the water system **410** "no" soft button **412**, or push the hard button **416***a* on the a cell phone, smart phone or similar apparatus **400** which will communication with the remotely controllable base station **200** via the internet, wireless technology (e.g. Bluetooth, Zigbee), and/or cellular format technology and then the paired remotely controllable base station **200** would turn off the water system off and then when completed (specified by switches and/or a flow sensor) will send a returned communication signal to the a cell phone, smart phone or similar apparatus **400** and turn on signal (audio or visual) message **409** that the water system is off.

Now referring to FIG. **9** which shows a perspective view of the embodiment comprising a home with the remotely controllable base station **200** with shut-off/on mechanism interposed between the main water supply system **208** and the first distribution line for the home or company **210** and communicating wirelessly with a cell phone, smart phone or similar apparatus **400** held in the hand **221** of an individual **212**. The cell phone, smart phone or similar apparatus **400** communicates with the remotely controllable base station **200** with water shut-off/on mechanism **310** using Bluetooth wireless technology communication **420***a*, WIFI wireless communication **420***b*, or cellular wireless communication **420***c*.

An optional flow sensor **280** can be incorporated in the remotely controllable base station **200** to monitor water flow. The flow sensor **280** can be used to send the signal through the CPU/microprocessor to the remote controllers **218**, **220** and **244** for confirmation that the water flow has been interrupted. While the position of the shut-off/on mechanism valve **310** can also be used for this purpose, for additional confirmation that the water flow has been interrupted. The optional flow sensor **280** receives electrical energy through power line **282** and a ground line **284**.

FIG. **10** is a block diagram of the present invention, under another embodiment that provides additional integrity technology for the transfer of data. At a home or business customer premises, a broadband modem (e.g. cable, DSL, satellite or other service) and router **444** connects and manages the remotely controllable base station **200**. The broadband modem and router **444** communicate with the remotely controllable base station **200** or insurance company, municipality agencies and/or third party station **470** located in the service provider's data center (or hosted by an insurance, municipality agencies and/or third party monitoring, and data center) with the communications takes place via a communication network **434**, **436** (e.g., cellular network, internet, etc.). These Remote Operation Service Centers **452** manage the system operations necessary to deliver the integrity of the system service described herein. The combination of the broadband modem/router **444** and the Remote Operational Service Center **452** enable a wide variety of support type devices **430** (e.g., PCs, mobile phones and PDAs, computers, televisions) to communicate with the base station **200** allows users to remotely control the residential or commercial water supply.

The Remote Operation Service Center **452** is managed by a service provider via the browser-based Service Provisioning Delivery and Maintenance applications **454** that are provided within the Remote Operational Service Center **452**. Or, if preferred, the service can be more tightly integrated securely with the existing OSS/BSS **456** and service delivery systems **462** via the Web Services-based XML APIs **464** to Association Servers **458**.

The integrated insurance, municipality agency or other third party service **470** can also coordinate the monitoring of compliance data use and/or perform the services of the Remote Operational Service Centers **452** and the optional communication with the internet **434**.

In addition to HTTP or HTTPS communications **422**, the broadband modem and router **444** and Remote Operation Service Center **452** can support the use of a cellular network **436** (both GPRS, GSM and CDMA options are available) as another means to provide the primary broadband connection

438 to the internet 434. However, currently available broadband modems and routers are unable to communicate view 436 as the required electronics are not incorporated into the electrical circuitry. In spite of this, broadband routers such as those currently seen in homes or companies are enabled to communicate with the internet via a DSL line (over the switch telephone network (PTSN) or cable modem. One viable option is to build a cellular network circuitry into the broadband router or remote base station. Alternately, a smart phone can be used as a "hotspot". When configured as such, the smart phone "hotspot" turns instantly into a broadband router to which the remotely controllable base station 200, PC, or television 430 can communicate with the internet.

FIG. 11 is a block diagram of components of the present invention, under an embodiment, showing a more detailed description of the components. The diverse collection of apparatus/devices 480 range from computer browsers 482, PCs, PC applications or programs 484 or touch screen keypads, mobile devices 486, email 488, hub 490 or wireless (GPRS, GSM or CDMA) or internet connected televisions 492.

The apparatus/devices 480 accessing a Web Portal application 494 through the internet 434, performs an end-user configuration and customization of the integrated service. Additionally device management is capable of performed by this portal application. A mobile device 486 (e.g., PDA, mobile phone, etc.) accessing the integrated system Mobile Portal 500. PC or browser-based "widget" devices 484 that present integrated security system service content, as well as other third-party content, in simple, targeted ways.

There are numerous types of server components of the Remote Operation Data Service Center 452. Business Components which manage information about the controlling/monitoring devices, using Web 2.0, and XML APIs (see FIG. 10). Within the OSS/BSS Components are the Customer Help Desk 502 which provides information about remote devices and base station installment instructions and operation and technology questions. The Service Delivery and Management Application 504 enables operators to administer the service (these components also access the Business Components via the XML APIs, and also via published SNMP MIBs). Service provisioning 506 can be used to include a 3rd party to monitor leak flow sensors located at a residence or company and provide alarms or send messages to the client when water leak problems are detected. If the residence or company hires a 3rd party or has account with a 3rd party, an insurance company and/or municipality agencies, the Order, Management and Billing Component 508 will manage this service.

The server components provide access, and management of, the objects associated with an integrated broad. It is a location where modem/router 444 and remotely controllable base station 200 is located in a home or company, and is also commonly referred to as a site or premises; the site or premises can include any type of structure (e.g., home, office, warehouse, etc.) at which a modem/router 444 and the remotely controllable base station 200 are located. Remote devices can only access the networks to which they have been granted permission through activation (e.g. pairing process).

The low-level service management activities for the integrated system service. They define all of the remote devices, for example, the cell phone, smart phone or similar apparatus 400, computer browser 482, PC applications or programs 484 or TV 492 (internet capbability), associated with residential or corporate premise network, analyze how the devices interact, and trigger associated actions (such as sending signals to turn on or off the water system, or provide notifications to home or company owners). All changes in device states are monitored and logged for subsequent evaluation. The Business Components also manage all interactions with external systems as required, including sending alarms and other related self-monitoring data to the owners or the optional insurance, municipality agency or a third party monitoring station. The following Business Components manage the main elements of the integrated security system service, but the embodiment is not so limited: A Registry Manager 526 defines and manages remote devices and networks. This component is responsible for the creation, modification and termination of devices and networks. A Network Manager 524 defines and manages security and self-monitoring devices that are deployed on a network (site). This component handles the creation, modification, deletion and configuration of the devices, as well as the creation of automations, schedules and notification rules associated with those devices. A Data Manager 532 manages access to current and historical state data for an existing network and its devices. This component specifically does not provide any access to network management capabilities, such as adding new devices to a network, which are handled exclusively by the Network Manager 524. To achieve optimal performance for all types of queries, data for current device states is stored separately from, but linked together, in the historical activity data (a.k.a. "logs") in the database. A Log Data Manager 532 performs ongoing transfers of the device state data to the historical activity data log tables.

Additional Business Components direct manage communications with certain remote devices and systems. For example, Hub Manager 530 directly manages all communications with the remotely controlled base station 200 and the remote devices 480 receiving information about device state changes, changing the configuration of devices, and downloading new versions or software updates to the base station 200 and/or remote devices 480 hardware. A Notification Manager 528 is responsible for sending all notifications to clients via SMS (mobile phone messages), email (via a relay server like an SMTP email server), etc. The Element Management System 522 is a Business Component that manages all activities associated with service installation, scaling and monitoring, and filters and packages service operations data for use by the service management applications.

The Business Components store information about the objects that they manage in the Control Service Database 536. The Control Service Database 536 stores information about users, networks, devices and logged activities. This database interaction is performed via an appropriate interface. For security purposes, the various Business Components manage all data storage and retrieval. The various Business Components provide web services-based APIs that application components use to access the various Business Components' capabilities. Functions of application components include presenting integrated security system service data to end-users, performing administrative duties, and integrating with external systems and back-office applications.

The primary published APIs for the Business Components include, but are not limited to, the following: A Registry Manager API 518 provides access to the Registry Manager Business Component's functionality, allowing management of networks and devises. A Network Manager API 518 provides access to the Network Manager Business Component's functionality, allowing management of devices on a network. A Data Manager API 518 provides access to the Data Manager Business Component's functionality, such as setting and retrieving (current and historical) data about device states. A

Provisioning API **516** provides a simple way to create new networks and configure initial default properties.

Each API of an embodiment includes two modes of access: Java API or XML API. The XML APIs are published as web services so that they can be easily accessed by applications or servers over a network. The Java APIs are a programmer-friendly wrapper for the XML APIs. Application components and integrations written in Java should generally use the Java APIs rather than the XML APIs directly.

The Business Components also have an XML-based interface **538** for quickly adding support for new devices to the integrated security system. This interface **538** is a flexible, standards-based mechanism for defining the properties of new devices and how they can be managed. Although the format is flexible enough to allow the addition of any type of future device, pre-defined XML profiles are currently available for adding common types of devices such as sensors **540**.

Once a user sets up a service, an Activation Application **494** delivers a first display to the user on either a display mean on the remotely controlled base station **200** and/or on a display means on the remote devices **480**. This pairing technology or other application secure means associates a new user with a purchased remote device **480** and the remotely controlled base station **200**. It primarily uses functionality published by the Provisioning API. Alternately, a Web Portal Application **496** can run on PC and cell phone browsers and delivers the web-based interface to the integrated system devices. This application allows users to manage their networks (e.g. add devices and create automations) as well as to view/change device states. Because of the wide scope of capabilities of this application, it uses three different Business Component APIs that include the Registry Manager API, Network Manager API, and Data Manager API. A Mobile Portal **500** is a small-footprint web-based interface that runs on mobile phones and PDAs. Potentially, the interaction with the Business Components is primarily via the Data Manager API. Custom portals and targeted client applications can be provided leveraging the same Business Component APIs used by the above applications. A Content Manager Application Component **498** delivers content to a variety of users. It sends multimedia-rich user interface components to widget container clients (both PC and browser-based), as well as to advanced touchscreen keypad clients.

A number of application components ensure overall management of the service. These pre-defined applications, referred to as Service Management Application Components **512**, are configured to offer off-the-shelf solutions for production management of the integrated security system service including provisioning, overall service monitoring, customer support, and reporting, for example. The Service Management Application Components **512** allows service administrators to perform activities associated with service installation, scaling and monitoring/alerting. This application interacts heavily with the Element Management System **522** Business Component to execute its functionality, and also retrieves its monitoring data from that component via protocols such as SNMP MIBs. The CSR APP and Report Generator **510** is useful for provide reports in specific format for residential home owners and user, company owner and users, and/or the insurance company or a municipality agency. A Kitting Application **514** is used by employees performing service provisioning tasks.

FIG. **12** is a block diagram including base station software or applications. The base station software architecture has relatively small programmed instructions that are efficient, thereby simplifying its integration into other consumer appliances such as service routers. The software architecture also provides a high degree of security against unauthorized access. This section describes the various key components of the base station software architecture.

The control software includes a hub application layer **580** which is the main program that orchestrates the operations the device connection software **582**, the modem/router connection **584** and the optional base LED/LCD panel connection **584**. The Security Engine **588** provides robust protection against intentional and unintentional intrusion into the integrated remotely controllable base station **200** (both from inside the premises as well as from the WAN, LAN or Internet or outside premises). The Security Engine **588** comprises one or more sub-modules or components that perform functions including, but not limited to, the following: Encryption including 128-bit SSL encryption to provide secure communication. Bi-directional authentication between the remotely controllable base station **200** and the remote device **480** is used to confirm that the software instructs have been completed. Data sent from the modem/router server **444** to the remote device **480** (or vice versa) is digitally signed as an additional layer of security. Non-repudiation technology that prevents a sender from denying that a message, data or information was sent can be incorporated. Digital signing provides both authentication and validation that the data has not been altered in transit. The modem/router **444** provides for 128-bit SSL encapsulation of signal data sent over the internet **434** for complete integrity. Wireless IEEE 802.11b/g/n/x with WEP, WPA-PSK [TKIP], WPA2-PSK [AES], WPA-PSK [TKIP]+ WPA2-PSK [AES] or other security protocol variant to ensure that signals and communications always takes place using the strongest available protection. Attempts to activate gateway-enabled devices by intentional and unintentional intrusion are detected by the Security Engine. Pairing remote devices **480** have the information with the correct serial number or activation key (pairing) can be activated for use with remotely controllable base station **200**.

As standards evolve, and new encryption and authentication methods are proven to be useful, and older mechanisms proven to be breakable, the remote devices **480** and the remotely controllable base station **200** or components of the OSS/BSS can be upgraded by downloading updated software wirelessly or by a physically means of swapping out electrical components to provide new and better security for communications between the remote devices **480** and the remotely controllable base station **200**.

A firmware download module **590** allows for secure updates to the modem/router **444** or remote device firmware through the Maintenance Application **594** providing a transparent, hassle-free mechanism for the service provider to deploy new features and bug fixes to the installed user base. The firmware download mechanism **590** is tolerant of connection loss, power interruption and user interventions (both intentional and unintentional). Such robustness reduces down time and customer support issues.

The schedules/automation engine **582** manages the user-defined rules of interaction between the different devices and for executing the user defined schedules of the off/on water system schedules.

Device connection software **582** includes definitions of all supported devices (e.g., key chains, mobile phones, water sensors, etc.) using a standardized plug-in architecture. The device connection module **582** offers an interface that can be used to quickly add support for any new device as well as enabling interoperability between devices that use different technologies/protocols. For common device types, pre-defined sub-modules have been defined, making supporting new devices of these types even easier.

The device management module **594** is in charge of all discovery, installation and configuration of both wired and wireless IP devices coupled or connected to the system. Networked IP devices require user configuration of many IP and security parameters to management module of an embodiment handles the details of this configuration. The device management module also manages the video routing module described below.

While this invention has been described as having a preferred design, the present invention can be further modified within the spirit and scope of this disclosure. The application is therefore intended to cover any variations, uses, or adaptations of the invention using its general principles. Further, this application is intended to cover such departures from the present disclosure that arise from known or customary practice and the art to which this invention pertains and which fall within the limits of the appended claims.

The invention claimed is:

1. A building or structure water damage prevention system, said system comprising:

a remotely controllable base station with a water shut-off/on or water control mechanism interposed between a water line from a water main and a water supply for said building or structure;

said remotely controllable base station with said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;

a wireless chain or key fob apparatus;

said remotely controllable base station including a recording compliance data means;

said key chain or key fob apparatus includes electronic circuitry to send a wireless signal to said remotely controllable base station to turn said water supply on and off, and

said key chain or key fob apparatus having the capability to receive a wireless electronic communication whereby said key chain or key fob apparatus includes an indicating means for determining an operational state or position of the shut-off/on mechanism.

2. A building or structure water damage prevention system as recited in claim **1**, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for said building or structure, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.

3. A building or structure water damage prevention system as recited in claim **1**, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.

4. A building or structure water damage prevention system as recited in claim **1**, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.

5. A building or structure water damage prevention system as recited in claim **1**, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.

6. A building or structure water damage prevention system as recited in claim **5**, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source.

7. A building or structure water damage prevention system as recited in claim **1**, wherein said shut-off/on mechanism includes a temperature sensor and/or freeze plug that is designed to initiate operations to prevent water pipe damage during freezing conditions.

8. A building or structure water damage prevention system, said system comprising:

a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;

said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;

a wireless cell phone, smart phone or similar apparatus in wireless communication with said remotely controllable base station with shut-off/on mechanism;

said remotely controllable base station including a recording compliance data means;

said cell phone, smart phone or similar apparatus having an application ("APP"), that functions to cooperate with said cell phone, smart phone, or similar apparatus to send a wireless signal to said base station, said signal functions turning said water supply on or off;

said cell phone, smart phone, or similar apparatus having an application that communicates wirelessly with said base station to receive a wireless communication that provides an indicating means for determining an operational state or position of the shut-off/on mechanism, and

said cell phone, smart phone or similar apparatus having the capability to receive a wireless electronic communication whereby said cell phone, smart phone or similar apparatus includes an indicating means for determining the operational state or position of the shut-off/on mechanism.

9. A building or structure water damage prevention system as recited in claim **8**, wherein said base station with remotely controllable base station with shut-off/on mechanism is interposed between the water supply line for a sprinkler system and the water line for a household or industrial/commercial building, such that such that operation of said sprinkler system is not interrupted by the activation of the base station with shut-off/on mechanism.

10. A building or structure water damage prevention system as recited in claim **8**, wherein said water base station with shut-off/on mechanism further comprises a programmable time circuitry, said time circuitry being adapted to actuate the shut-off/on mechanism for a programmable determined time.

11. A building or structure water damage prevention system as recited in claim **8**, further comprising a mechanical adaptor that enables an override to allow water flow when the base station with shut-off/on mechanism is activated.

12. A building or structure water damage prevention system as recited in claim **8**, wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.

13. A building or structure water damage prevention system as recited in claim **12**, further comprising a water turbine generator, solar cell and/or wind generation system to provide supplemental electrical energy to a battery source.

14. A building or structure water damage prevention system as recited in claim **8**, wherein said shut-off/on mechanism includes a temperature sensor or freeze plug that is designed to initiate operations to prevents water pipe damage during freezing conditions.

15. A building or structure water damage prevention system as recited in claim **8**, wherein said base station with water shut-off/on mechanism includes flow sensor to measure water volume that can be transfer water flow data or information to said cell phone, smart phone or similar apparatus, said base station with water shut-off/on mechanism and flow sensor interposed between a main water meter and the water supply for said building or structure, or functions as the main water meter.

16. A building or structure water damage prevention system as recited in claim **8**, wherein said base station with shut-off/on mechanism can be programmed to follow a specific schedule for interrupting the water flow or allowing the water flow into the building or structure.

17. A building or structure water damage prevention system as recited in claim **8**, wherein said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus includes pairing technology to provide a specific wireless communication means between said remotely controllable base station and said wireless cell phone, smart phone or similar apparatus.

18. A building or structure water damage prevention system as recited in claim **8**, wherein said wireless communication between said remotely controllable base station and said cell phone, smart phone or similar apparatus utilizes a remote operation service center to provide further integrity of communication signals.

19. building or structure water damage prevention system as recited in claim **8**, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.

20. building or structure water damage prevention system as recited in claim **8**, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus or communicates with a residential or industrial/commercial owner or municipality agency or insurance company when a leak is detected by one or more leak sensors.

21. A building or structure water damage prevention system, said system comprising:
- a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;
- said remotely controllable base station with a said water shut-off/on or mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;
- an alarm or computer system;
- said remotely controllable base station including a recording compliance data means;
- said alarm or computer system includes electronic circuitry to send a wireless signal to said remotely controllable base station to turn said water supply on and off, said wireless signal utilizing encryption, authentic, integrity and/or non-repudiate technology, and
- said alarm or computer system having the capability to receive a wireless electronic communication whereby said alarm or computer includes an indicating means for determining an operational state or position of the shut-off/on mechanism.

22. A building or structure water damage prevention system, said system comprising:
- a remotely controllable base station with a water shut-off/on mechanism interposed between a water line from a water main and a water supply for said building or structure;
- said remotely controllable base station with a said water shut-off/on mechanism being adapted to control the flow of water through said water supply to a residential home or industrial/commercial facility or building;
- a wireless garage door opener apparatus;
- said remotely controllable base station including a recording compliance data means;
- said wireless garage door opener apparatus includes electronic circuitry to send a wireless signal to said remotely controllable base station to turn said water supply on and off, and
- said wireless garage door opener apparatus having the capability to receive a wireless electronic communication whereby said wireless garage opener includes having an indicating means for determining an operational state or position of the shut-off/on mechanism.

23. A building or structure water damage prevention system as recited in claim **21** wherein said remotely controllable base station includes one of more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.

24. A building or structure water damage prevention system as recited in claim **22** wherein said remotely controllable base station includes one or more flow sensors and can be programmed to turn off the water supply upon the detection of a leak by one or more flow sensors.

25. A building or structure water damage prevention system as recited in claim **1**, said wireless key chain or key fob apparatus and said remotely controllable base station requires an initial pairing operation to provide a specific wireless communication means between with said wireless key chain or key fob apparatus and said remotely controllable base station.

26. A building or structure water damage prevention system as recited in claim **21**, said alarm or computer system and said remotely controllable base station requires an initial pairing technology to provide a specific wireless communication means between with said alarm or computer system and said remotely controllable base station.

27. A building or structure water damage prevention system as recited in claim **22**, said wireless garage door opener and said remotely controllable base station requires an initial pairing technology to provide a specific wireless communication means between with said wireless garage door opener and said remotely controllable base station.

28. A building or structure water damage prevention system as recited in claim **8**, wherein said cell phone, smart phone or similar apparatus utilizes remote servers and software networks to increase the integrity of cell tower and WI-FI wireless communication.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,297,150 B2
APPLICATION NO. : 13/776963
DATED : March 29, 2016
INVENTOR(S) : Michael Klicpera

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Column 15, Lines 46-47, the portion of the sentence that reads “In operation, an individual who wants to turn off the water system would touch the off the soft button 406 or reply to the . . .” should read - In operation, an individual who wants to turn off the water system would touch the off soft button 406 or reply to the . . . -

Column 15, Line 67 to Column 16, Lines 1-2, the portion of the sentence that reads “. . . cellular format technology and then the paired remotely controllable base station 200 would turn off the water system off and then when completed (specified by the switches and/or a flow . . .” should read - . . . cellular format technology and the paired remotely controllable base station 200 would turn off the water system and then when completed (specified by the switches and/or a flow . . . -

In the Claims

Claim 19 reads “building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the phone, smart phone or similar apparatus when the phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off.” should read - A building or structure water damage prevention system as recited in claim 8, wherein said remotely controllable base station calls or sends a text message to the cell phone, smart phone or similar apparatus when the cell phone, smart phone or similar apparatus is a defined distance from the remotely controllable base station when the water has not been turned off. -

Signed and Sealed this
Twenty-fourth Day of April, 2018

Andrei Iancu

Andrei Iancu
Director of the United States Patent and Trademark Office

Electronic Patent Application Fee Transmittal	
Application Number:	
Filing Date:	
Title of Invention:	WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM
First Named Inventor/Applicant Name:	Michael Edward Klicpera
Filer:	Michael E. Klicpera
Attorney Docket Number:	70947.01
Filed as Micro Entity	
Filing Fees for ex parte reexam	

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
EX PARTE REEXAMINATION (1.510(A)) NON-STREAMLINED	3812	1	3000	3000
Pages:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
	Total in USD ($)			**3000**

Electronic Acknowledgement Receipt

EFS ID:	36773508
Application Number:	90014354
International Application Number:	
Confirmation Number:	1805
Title of Invention:	WATER USE MONITORING APPARATUS AND WATER DAMAGE PREVENTION SYSTEM
First Named Inventor/Applicant Name:	Michael Edward Klicpera
Customer Number:	22509
Filer:	Michael E. Klicpera
Filer Authorized By:	
Attorney Docket Number:	70947.01
Receipt Date:	02-AUG-2019
Filing Date:	
Time Stamp:	17:53:13
Application Type:	Reexam (Patent Owner)

Payment information:

Submitted with Payment	yes
Payment Type	EFT
Payment was successfully received in RAM	$3000
RAM confirmation Number	E201982H55210178
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Recpt of Orig ExParte Reex < 40 Pgs Rule1.20(C)(1)	Request-ExParte-Reexamination-Transmittal-Form-150.pdf	253432 f4772790e049ac26389b86a5f2f1da7b8b749a1d	no	4
Warnings:					
Information:					
2	Recpt of Orig ExParte Reex < 40 Pgs Rule1.20(C)(1)	150_Patent_Reexamination_Cover_Letter.pdf	2768436 31c8e8a76e8848c9d0ad00795b27655680c4b6d9	no	7
Warnings:					
Information:					
3	Reexam - Info Disclosure Statement Filed by 3rd Party	updated_IDS_150-image.pdf	1010476 95611238bb6e2511bcb7647640e8de947e977eee	no	6
Warnings:					
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Warnings:					
Information:					
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Warnings:					
Information:					
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Warnings:					
Information:					

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Warnings:					
Information:					
12	Applicant Arguments/Remarks Made in an Amendment	Amended_Spec_and_Claims-9297150.pdf	4230358 d3b8acd359ee4de56c7714ee9aade934d71ba9c0	no	17
Warnings:					
Information:					
13	Copy of patent for which reexamination is requested	9297150.pdf	2011905 cde3d7062f23e6fdcf66ca8fff43fd64d59236f7	no	24
Warnings:					
Information:					

14	Reexam Miscellaneous Incoming Letter	PriorArtPatent1-4image.pdf	16079693 f560c3e64208d1da0d4090b9bb6bbd9dc9f82296	no	65
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Information:					
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Information:					
16	Fee Worksheet (SB06)	fee-info.pdf	29995 654eaadf13b9b9bc00884fb99ca1654ca5a4a522	no	2
Warnings:					
Information:					
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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
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If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

US005719564A

United States Patent [19]

Sears

[11] Patent Number: 5,719,564

[45] Date of Patent: Feb. 17, 1998

[54] UTILITY METER READING SYSTEM

[76] Inventor: Lawrence M. Sears, 23905 Mercantile Rd., Beachwood, Ohio 44122

[21] Appl. No.: 644,501

[22] Filed: May 10, 1996

[51] Int. Cl.[6] G08B 23/00

[52] U.S. Cl. 340/870.02; 340/870.03; 340/870.11; 340/825.54; 340/870.04

[58] Field of Search 340/870.02, 870.03, 340/870.31, 870.15, 870.06, 310.01, 870.11, 825.54, 870.04

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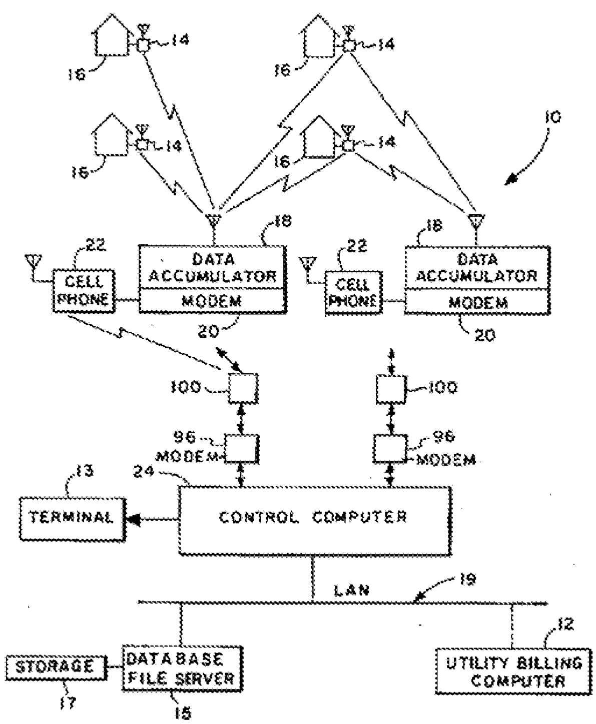
Primary Examiner—Jeffery Hofsass
Assistant Examiner—Albert K. Wong

[57] ABSTRACT

A method for communicating utility usage-related information from a plurality of meter modules to a plurality of data accumulator units, each of which periodically transmits data to a control computer, including the steps of periodically transmitting from each meter module a first signal indicative of utility usage-related information and wherein the first signal includes a flag for self-configuring the communications network when the meter module is initially installed. The signal strength of the first signals from a meter module received at a data accumulator unit are measured and ranked by the control computer based on received signal strength. The ranking based on signal strength is utilized to enable only a limited number of data accumulators (those which received the strongest first signals) to receive, record and store data from a particular meter module.

30 Claims, 4 Drawing Sheets



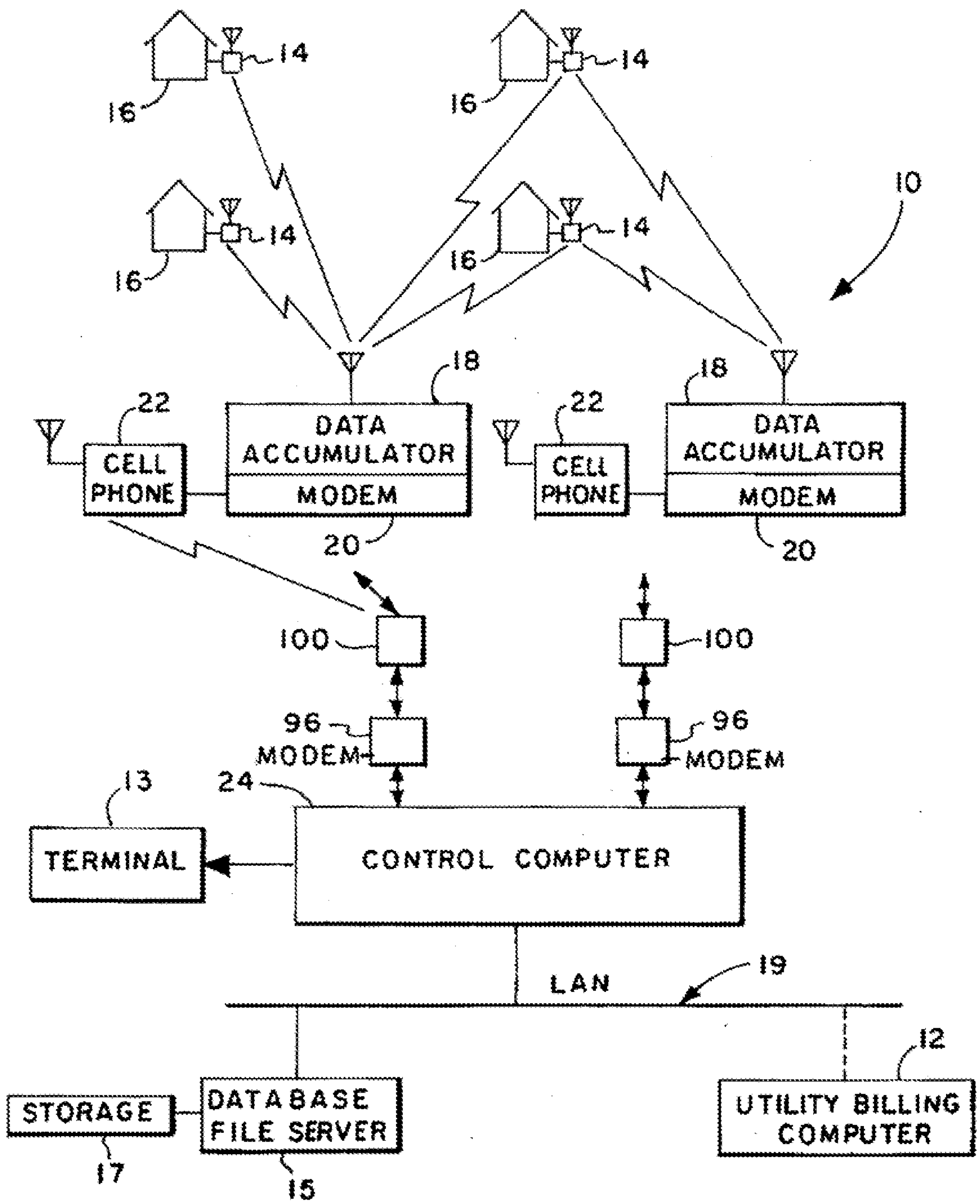

14
16
14
16
10
14
16
14
16
18
22
DATA ACCUMULATOR
CELL PHONE
MODEM
20
18
22
DATA ACCUMULATOR
CELL PHONE
MODEM
20
100
100
96
MODEM
96
MODEM
13
24
TERMINAL
CONTROL COMPUTER
LAN
19
12
STORAGE
DATABASE FILE SERVER
UTILITY BILLING COMPUTER
17
15

FIG. 1

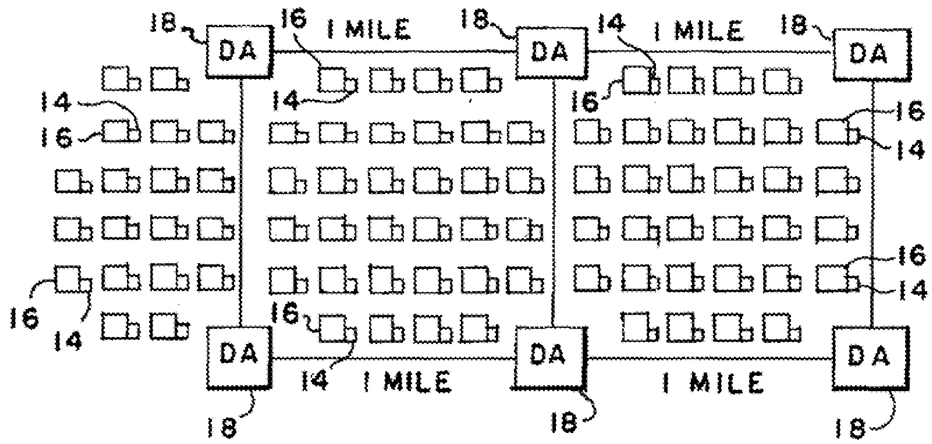

DA
DA
DA
DA
DA
DA
1 MILE
1 MILE
1 MILE
1 MILE
18
16
14

FIG. 2

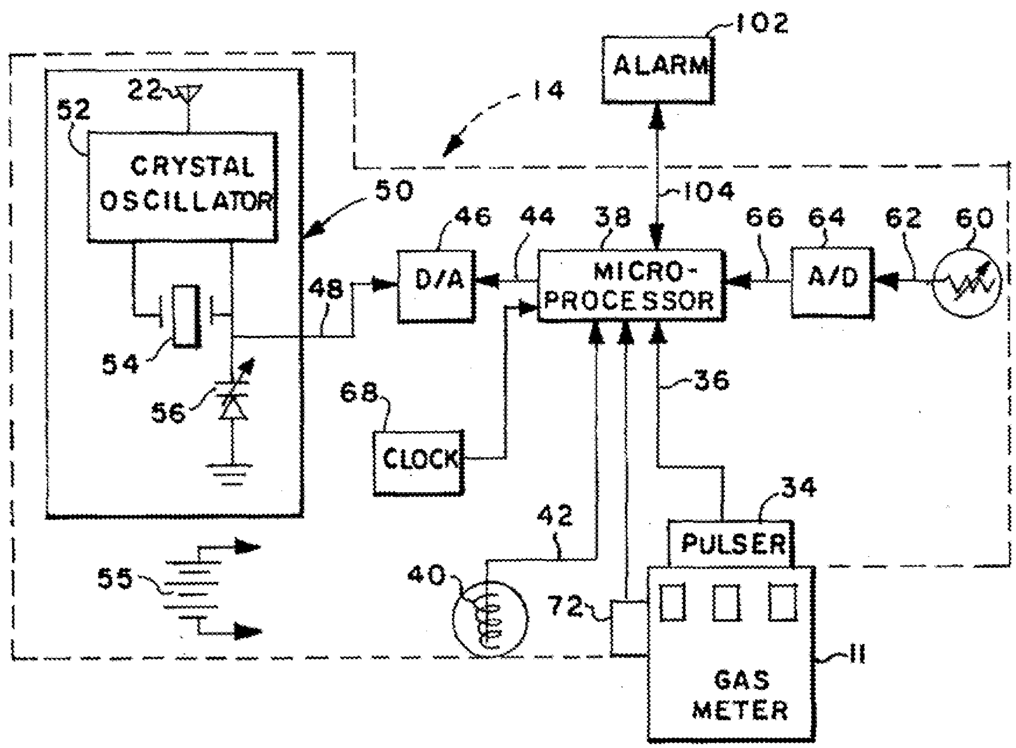

102
ALARM
14
22
52
CRYSTAL OSCILLATOR
50
104
46
44
38
66
64
62
60
48
D/A
MICRO-PROCESSOR
A/D
54
56
68
CLOCK
36
34
42
PULSER
55
40
72
GAS METER
11

FIG. 3

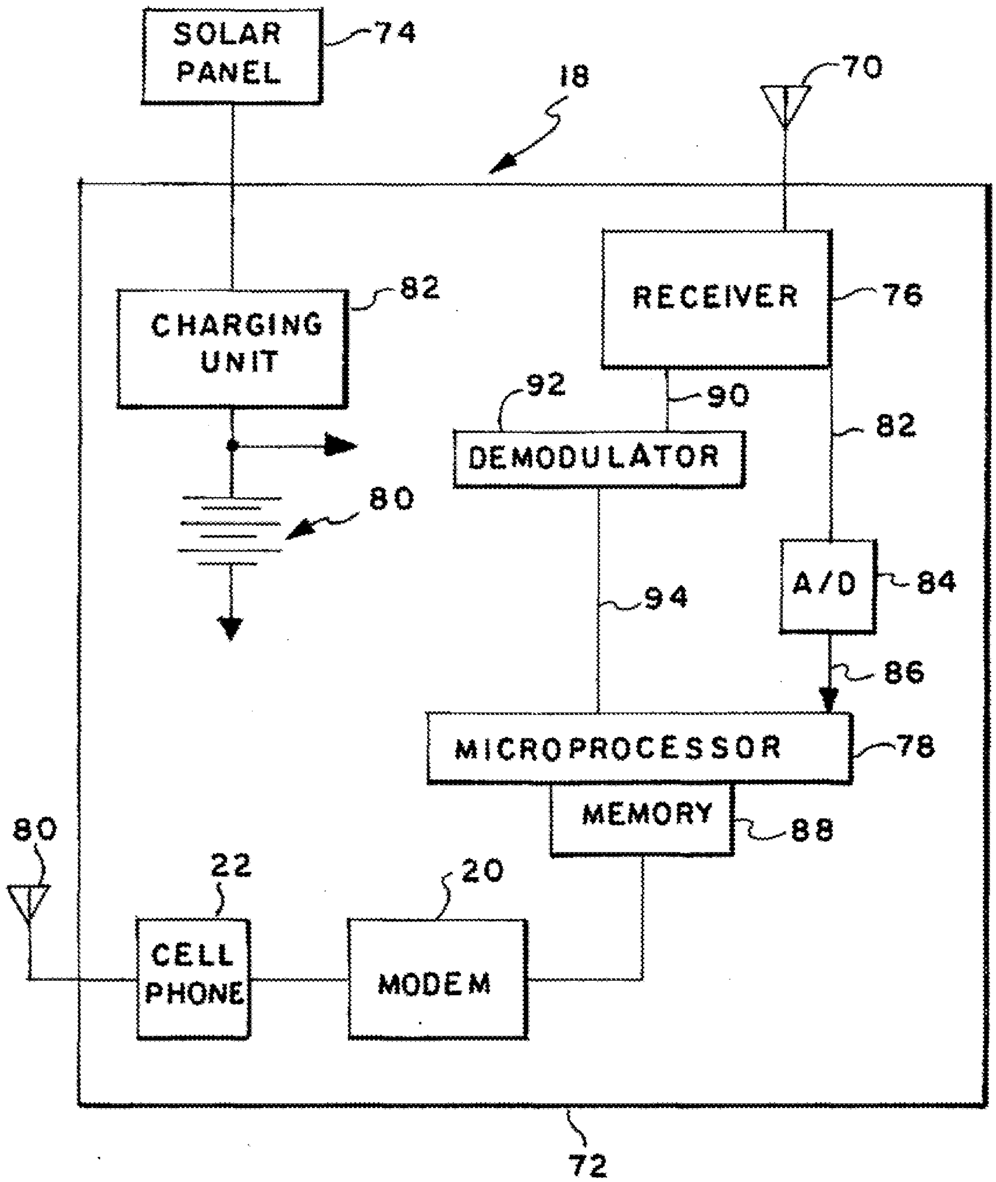

SOLAR PANEL
74
18
70
CHARGING UNIT
82
RECEIVER
76
92
90
82
DEMODULATOR
80
A/D
84
94
86
MICROPROCESSOR
78
MEMORY
88
80
22
20
CELL PHONE
MODEM
72

FIG. 4

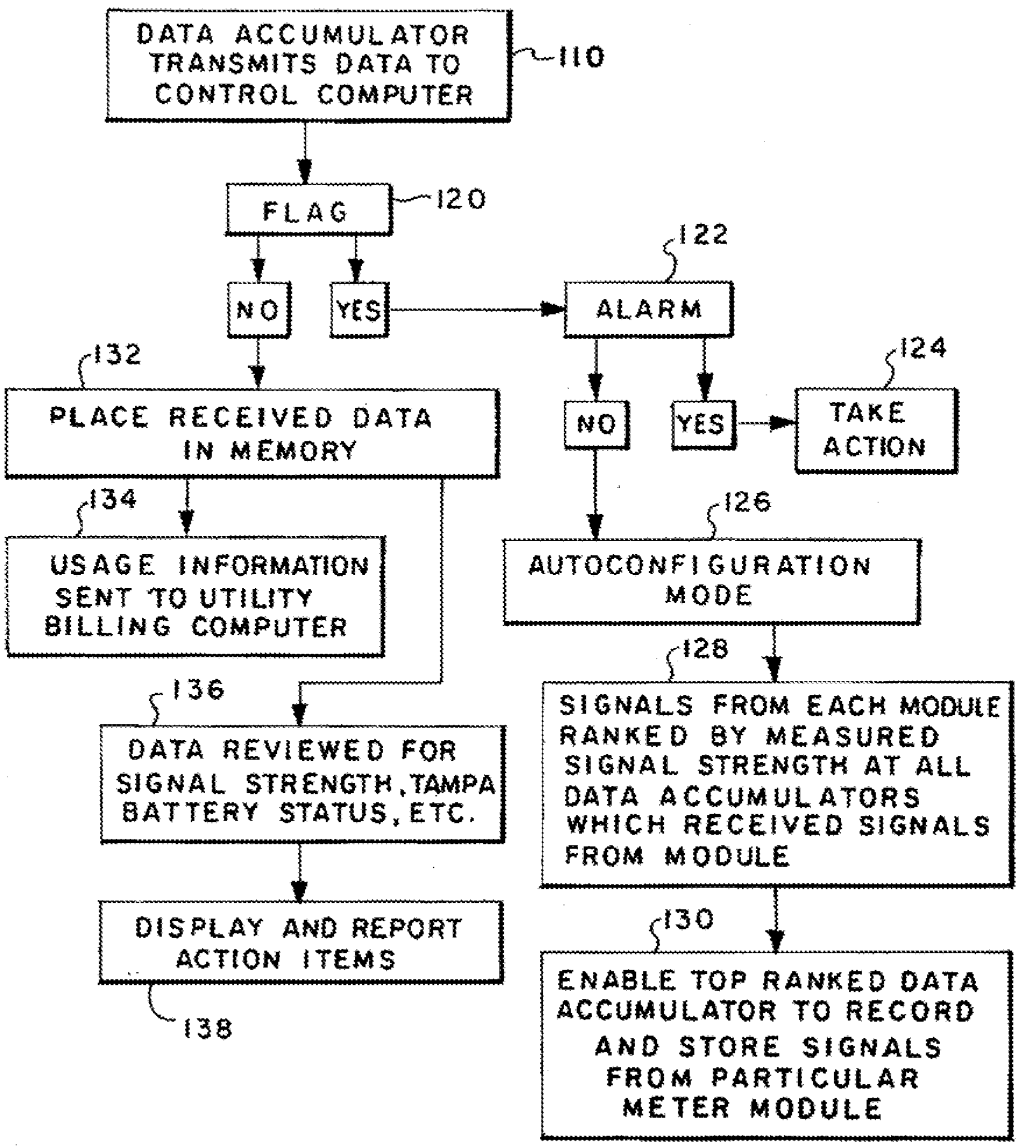

DATA ACCUMULATOR TRANSMITS DATA TO CONTROL COMPUTER
110
FLAG
120
NO
YES
ALARM
122
132
PLACE RECEIVED DATA IN MEMORY
NO
YES
TAKE ACTION
124
134
USAGE INFORMATION SENT TO UTILITY BILLING COMPUTER
126
AUTOCONFIGURATION MODE
128
136
DATA REVIEWED FOR SIGNAL STRENGTH, TAMPA BATTERY STATUS, ETC.
SIGNALS FROM EACH MODULE RANKED BY MEASURED SIGNAL STRENGTH AT ALL DATA ACCUMULATORS WHICH RECEIVED SIGNALS FROM MODULE
DISPLAY AND REPORT ACTION ITEMS
130
138
ENABLE TOP RANKED DATA ACCUMULATOR TO RECORD AND STORE SIGNALS FROM PARTICULAR METER MODULE

FIG. 5

UTILITY METER READING SYSTEM

DESCRIPTION

1. Technical Field

The present invention relates to a method and apparatus for communicating utility usage-related information such as meter identification data and utility usage data from a plurality of meter modules, each of which senses, stores and periodically transmits utility usage information via an RF link to a plurality of spaced-apart data accumulator units, each of which receives from a plurality of meter modules a plurality of first signals indicative of the utility usage information associated with the meter module which transmits the signal. The data accumulator units then periodically transmit information to a control computer which downloads the data to a utility computer network which then processes the data and produces billing information. Redundancy of signals sent to the data accumulator units assures reliable signal reception in various propagation environments and the control computer minimizes redundant signals from a particular meter module from being processed by an unnecessarily large number of data accumulator units so as to to significantly reduce the amount of data processed while still obtaining accurate information.

2. Background of the Invention

Meter reading systems are well known in the art. Such known systems include hand-held units and remote units which can read meters from a short distance and walk-by or drive-by systems which read meters via a short RF link (1" to 500') with a receiver located in a vehicle or hand held which is passed by the structures including the utility meters. Such a system is disclosed in U.S. patent application Ser. No. 08/119,986 filed Sep. 10, 1993 entitled "Apparatus for Communicating Utility Usage-Related Information from a Utility Usage Location to a Utility Usage Registering Device," which is incorporated herein by reference.

It is now desired to utilize a wide area, centralized reading system. Such systems increase the accessibility to meter data by enabling a meter to be read on a schedule or on demand as desired from a central location. Such a system eliminates meter readers and significantly reduce the cost of meter reading.

Known problems are associated with RF communications between the meter transmitters and the data receivers. The propagation of the transmission signal from the meter module is dependent upon topography, meter location, and local conditions such as interference, storms, and obstructions. The signals from the meter modules tend to attenuate in various environments and do not propagate in a uniform fashion.

To increase the probability that an accurate signal will be received from the meter modules, the data receiver which receives the signal from the meter module can be moved closer to the meter module. However, reducing the spacing between the meter modules and the data receiver requires increasing the number of data receivers. Additionally, since each meter module will transmit to all receivers or data accumulator units within its transmission range, a plurality of data accumulator units within range of a particular meter module will each receive signals from the particular meter module. This results in the data accumulator units receiving a plurality of redundant signals from a particular meter module. It has been found that particular data accumulator units located in densely populated areas could receive as many as 100,000 messages, the vast majority of which are redundant, from various meter modules in a 12 hour period. This results in the data accumulator units, the communications network, and other data processors processing large volumes of redundant data.

Hence, although it is desirable to receive the signals from each meter module at more than one data accumulator unit to enhance the probability of accurate reception, it is further desirable to reduce the redundancy of signals processed by the meter reading system so as to not overburden the data processing system.

The present invention overcomes the disadvantages associated with the prior art meter reading systems by automatically reducing the redundancy of the processed signals based on the strength of the signal received from a particular meter module at the plurality of data concentrator units.

SUMMARY OF THE INVENTION

The present invention provides a new and improved method of communicating utility usage-related information from a plurality of meter modules, each of which senses, stores and periodically transmits utility meter-related information from its associated utility meter to a plurality of spaced-apart data accumulator units, each of which receives from a plurality of meter modules, a plurality of first signals, each of which is indicative of the utility usage information associated with the meter module which transmits the first signal, and which further periodically transmits data indicative of some of the first signals received from the data accumulator units to a control computer, including the steps of periodically transmitting from the meter modules a signal indicative of utility usage-related information, receiving at each of the data accumulator units first signals, each of which is transmitted by its associated meter module, storing at the data accumulator units data indicative of utility-related information received by the data accumulator units from some of the first received signals, transmitting to the control computer from each of the data accumulator units information which is indicative of the utility usage information sensed by the plurality of meter modules, and periodically transmitting a flag in the first signal for a predetermined time period.

The present invention further provides a new and improved method of communicating utility usage-related information as set forth in the preceding paragraph wherein the signal strength of each of the received signals including a flag is determined and stored at the data accumulator units, and wherein the received signal strength is transmitted to the control computer which ranks, by the received signal strength, each of the received first signals including a flag, and enables only those limited number of data accumulator units which have received the strongest first signal based on rank from a particular meter to store and process the data indicative of utility usage-related information at that particular meter.

The present invention further provides a method of communicating utility usage-related information from a plurality of meter modules to a plurality of spaced-apart data accumulator units and further to a control computer, including the steps of periodically transmitting from each of the meter modules a first signal indicative of utility usage-related information, receiving at each of the data accumulator units a plurality of first signals, storing at the data accumulator units data indicative of utility-related information, transmitting to the control computer data from the data accumulator units, and wherein the step of periodically transmitting the first signal from each of the meter modules includes the steps of periodically transmitting at a first periodic frequency the

first signal from each of the meter modules, and periodically transmitting at a second periodic frequency, which is substantially larger than the first periodic frequency, the first signal from each of the meter modules. The step of periodically transmitting at the second periodic frequency is performed for a predetermined period of time when each of the meter modules is initially installed at its associated utility meter.

Still another provision of the present invention is to provide a new and improved method of communicating utility usage-related information from a plurality of meter modules to a plurality of data accumulator units and then to a control computer, including the steps of periodically transmitting from each of the meter modules a first signal indicative of utility usage-related information, receiving at each of the plurality of data accumulator units a plurality of first signals, determining the signal strength of the received first signals at each of the data accumulator units, storing at each of the data accumulator units the signal strength of the first signals received from each particular meter module which is within transmitting range of each data accumulator unit, storing of each data accumulator unit data indicative of utility usage information received in the first signal, determining which data accumulator units received the strongest signals, enabling only a limited number of data accumulator units which received the strongest signals from a particular meter module to store the data indicative of utility usage, and transmitting to the control computer data from each of the data accumulator units which is indicative of utility usage-related information sensed by the plurality of meter modules.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic representation of the meter reading system of the present invention.

FIG. 2 is a schematic representation of the grids established between the plurality of meter modules and the plurality of data accumulator units.

FIG. 3 is a schematic representation of a meter module constructed in accordance with the present invention.

FIG. 4 is a schematic representation of a data accumulator unit constructed in accordance with the present invention.

FIG. 5 is a simplified flow chart for the operation of the control computer.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the Figures, and more particularly to FIG. 1, a meter reading system **10** is disclosed for communicating utility usage-related information to a central computer **12** which is preferably located at the utility headquarters. The meter reading system **10** includes a plurality of meter modules **14**, each of which is associated with a utility meter **11** located at its associated utility usage location **16**. Each meter module **14** stores an identification number therein indicative of the particular utility meter being read, collects usage data, senses tamper, and includes a one-way, pseudo-random transmitter which periodically transmits, via an RF link, at a pseudo-random transmission frequency a first signal indicative of the utility usage-related information sensed and stored in the meter module **14**. The pseudo-random transmission frequency of the first signal is transmitted at a fixed carrier frequency at a transmission rate or interval which is pseudo-random. For example, the meter module **14** may tranmit on a carrier frequency of 450 MHz every approximately eleven hours i.e. the pseudo-random transmission frequency.

A plurality of data accumulator units **18** are spaced apart among the plurality of meter modules **14**. Each data accumulator unit **18** collects transmitted messages from a plurality of meter modules **14** and retransmits the messages via a modem **20** and a cell phone **22** to a control computer **24**. In the preferred embodiment, the data accumulator units **18** are spaced apart in a redundant grid, as is illustrated in FIG. 2, to increase the probability of reception by more than one data accumulator unit **18** of signals transmitted by each of the plurality of meter modules **14**. Typical spacing between data accumulator units is one mile, and each data accumulator unit **18** serves up to several thousand meter modules **14**. While a cell phone **22** has been illustrated to communicate between the data accumulator units **18** and the control computer **24**, other data links, such as RF, phone lines, cable, or photo-optic transmissions means can be utilized in a well-known manner to connect the data accumulator units **18** to the control computer **24**.

The data accumulator units **18** transmit the data stored therein indicative of utility usage at the meter modules to the control computer **24** which analyzes and filters redundant messages received by multiple data accumulator units. The control computer **24** functions as the gateway to the utility billing system, including the utility billing computer **12**, and controls the schedule for the download of data from the data accumulator units **18**. In addition, the control computer **24** functions to provide maintenance and management reports to the network manager. A terminal **13** can be connected to the control computer **24** to provide access by the network manager to the communicating network in a well-known manner. A suitable database file server **15** for storing information related to each of the utility use locations **16** in the storage means **17** is connected to the utility billing computer **12** and the control computer **24** through a local area network **19** in a well-known manner. The storage means **17** can be any known data storage means such as a tape drive or hard disc.

Each of the meter modules **14** normally transmits its first signal indicative of utility usage-related information at a pseudo-random transmission frequency. In the preferred embodiment, each meter module **14** transmits approximately once every 11 hours. This transmission frequency assures that the meter module will transmit a signal to be received by at least one data accumulator unit **18** at least twice per day. The utilization of a periodic transmission from the meter modules **14** approximately every **11** hours enables the time of transmission for each particular meter module **14** to vary so that the meter module **14** does not transmit at the same time each day. This increases the probability of reception of the signals from the meter modules **14** at the data accumulator units **18** even if there is a periodic, daily interference near the meter module **14**, i.e. if a signal is not received from a meter module **14** due to interference, the module will next transmit at a different time of day so that the probability of the next signal being jammed by periodic local interference is minimized. Even if one signal is not received by a data accumulator unit, multiple periodic transmissions increase the probability of an accurate reception of the first signal from a meter module **14**.

The high probability of reception by the data accumulator unit **18** from each meter module is based on the redundancy of the network (space diversity) and the frequency of transmissions (time diversity). For example, in a hilly area, the probability of reception of transmission signals from a meter module **14** to a single data accumulator unit **18** may

be reduced by as much as 50% if only a single data accumulator unit 18 receives signals from the particular meter module 14. However, by providing additional radio paths from the meter module 14 to other data accumulator units 18, the probability of reception of the signal from the meter module being received by at least one data accumulator unit increases to over 99%. In addition, if multiple transmissions occur from the meter module 14, the probability of successful reception increases from 99.1% for a single transmission to 99.99% for two transmissions. Thus, if a particular meter module transmission is not received, it is likely that the next or subsequent transmission will be received.

FIG. 2 illustrates a typical grid of meter modules 14 and data accumulator units 18 wherein the data accumulator units 18 are spaced on a grid approximately one mile apart, and the meter modules 14 are disposed in and around the grid to transmit to the data accumulator units. Typically, each meter module 14 transmits a signal indicative of utility usage over a distance of about one mile but the signal may, in some cases, be received up to three miles away.

The possible reception by more than one data accumulator unit 18 of the message from a single particular meter module 14 increases the probability of reception of the meter module messages but creates a large volume of redundant information. The control computer 24 functions to control the data accumulator units 18 to prevent the storage of redundant information at the data accumulator units 18.

Each data accumulator unit is designed to measure the actual signal strength of a signal received from a meter module 14. The data accumulator units 18 are adapted to store the utility usage information and the measured signal strength associated with the received first signals transmitted by the meter modules 14. Since, as indicated previously, a single data accumulator unit 18 could receive as many as 100,000 transmissions per twelve hour period in a densely populated area, it is desired to reduce the redundancy of information stored by the data accumulator units 18 and subsequently transmitted to the control computer 24.

Upon installation of each meter module 14, the meter module is actuated. Initial actuation of the meter module places the module in a NEWLY INSTALLED MODE. When the meter module 14 is in the NEWLY INSTALLED MODE, the meter module transmits a "flag" along with the utility usage-related information. In addition, the periodic transmissions from the meter module 14 (i.e. the frequency of the transmissions, not the designated carrier frequency of the signal) are at a significantly faster periodic frequency, such as one transmission per hour, than when the meter module is in its NORMAL TRANSMISSION MODE. Thus, each meter module is adapted to transmit in two distinct modes. In the NEWLY INSTALLED MODE, the periodic transmission frequency is increased, and a flag is included in the first signal. In the NORMAL TRANSMISSION MODE, the periodic frequency of transmission is reduced to about one transmission per eleven hours, and a flag is not included in the first signal transmitted by the meter module. The use of a flag in the first signal and the increase in periodic frequency of transmissions enables significant data to be quickly accumulated at the data accumulator units 18 to allow the control computer 24 to self-configure the meter reading system 10. The slower periodic frequency of transmission, without a flag, when the meter modules 14 are operating in a normal mode provides longer battery life for the batteries which power the meter module 14 and reduces the number of signals received and processed by the data accumulator units 18 and the associated network.

The meter module 14 can be manually activated to place the meter module in its NEWLY INSTALLED MODE at times other than installation of the meter module if it is desired to reconfigure the meter reading system 10.

The flag included in the first signal is preferably an identifier in the message (first signal) transmitted from the meter module 14 to the data accumulator unit 18. The particular flag data can identify a meter module as being in its NEWLY INSTALLED MODE or can indicate the occurrence of other significant events. The flag, however, could include means other than an identifier in the data of the first signal to indicate to the data accumulator units 18 that the particular signal received is from a meter module 14 operating in its NEWLY INSTALLED MODE. For example, the flag could be a change in the carrier frequency of the first signal rather than particular data included in the first signal.

When a data accumulator unit 18 receives a first signal from a meter module 14, the data accumulator unit 18 senses the signal strength of the received first signal and stores the received signal strength along with the utility usage-related information.

The data in the data accumulator units 18, including the signal strength of each signal, is downloaded to the control computer 24 on demand or on a periodic basis, preferably once per day. When the stored data from the data accumulator units 18 is downloaded into the control computer 24, the control computer 24 ranks each meter module by its received signal strength and identifies which data accumulator units 18 received the strongest receptions from a particular meter module 14. The data redundancy control computer 24 picks the top three or four data accumulator units 18, by rank of signal strength, and enables the selected data accumulator units 18 to receive and store signals received from the particular meter module 14. All other data accumulator units 18 will then be instructed to ignore any signals received from the particular meter module 14. For example, if a meter module 14 is located at 201 Elm Street, the system will determine, by rank, which data accumulator units 18 receive the strongest signal from 201 Elm Street. The three or four data accumulator units 18 which receive the strongest signal (highest rank) from 201 Elm Street are then instructed by the control computer 24 to record and store signals from 201 Elm Street. All other data accumulator units are instructed to ignore any signals from 201 Elm Street. This ranking by signal strength and selecting and enabling of the data accumulator units 18 by the control computer 24 is performed only when a flag is received in the first signal message from a meter module 14. Thus, the flag provides a means of self-configuring the system 10 for reading the meter modules 14 based on the actual received signal strength of the messages from the meter modules 14. The actual received signal strength will be dependent upon local conditions, and the system can configure itself to increase the probability of reception of signals from a particular meter module 14 while reducing the redundancy of data processed by the meter reading system 10.

If in the future the received signal strength from a particular meter module significantly decreases at a particular enabled data accumulator unit 18, the system 10 can reconfigure itself to disenable the data accumulator unit 18 which received the decreased signal strength to eliminate that data accumulator unit 18 as an enabled receiver for the particular meter module. The control computer 24 can then instruct another data accumulator unit 18 to receive, record and store signals from the particular meter module 14. The subsequently enabled data reduction unit 18 to receive, record and store signals from the particular meter module

will be based on the ranking of the signal strength from the meter module stored in the control computer **24**. This data is accumulated and stored when the meter module **14** is initially installed. For example, if three data accumulator units **18** are designated as enabled data accumulator units for a particular meter module **14** at 201 Elm Street, and subsequently a large structure such as a building is built between the meter module **14** at 201 Elm Street and one of the data accumulator units **18** which has been enabled and instructed to receive, record and store signals from 201 Elm Street, and a decrease in signal strength is sensed at the enabled data accumulator unit **18**, then control computer **24** can disenable the particular data accumulator unit **18** which received the first signal whose signal strength decreased by instructing that data accumulator unit **18** to ignore signals from the meter module at 201 Elm Street. The control computer **24** then enables another data reduction unit **18** as prime or enabled data accumulator unit for the particular meter module **14** at 201 Elm Street and instructs the newly enabled data accumulator unit **18** to receive, record and store signals from the meter module at 201 Elm Street. The subsequently enabled data accumulator unit **18** will be based on the rank of its received signal strength as stored in the control computer **24**. In this manner, the particular data accumulator units **18** which are designated as prime or enabled data accumulator units for a particular meter module **14** can be controlled so that only data accumulator units which receive a strong signal from a particular meter module **14** are utilized to receive, record and store the utility usage-related information from a particular meter module.

The control computer **24** also controls the download of data from each of the data accumulator units **18**. The data reduction control computer **24** can instruct each data accumulator unit **18** to transmit its stored data on demand or on a predefined schedule. Additionally, if desired, the control computer **24** can instruct the data accumulator unit **18** to receive and store data from a particular meter module **14** at the module's next periodic transmission. For example, the data accumulator units **18** may normally transmit data indicative of utility usage of the meter module **14** once per month but if a customer moved, a current reading may be required and the data accumulator may be instructed to send data indicative of utility usage of a particular meter at the next transmission.

A typical meter module **14**, illustrated in FIG. 3, includes a pulser **34**, a microprocessor **38**, and a crystal oscillator transmitter **50**. The pulser **34** detects utility usage at a gas, electricity or water meter **11** and sends a signal over line **36** to the microprocessor **38**. The pulser **34** will send the pulse to the microprocessor **38** every time the utility meter **11** registers the use of a predetermined amount of metered utility, for example, every 0.1 KW hours for an electric meter, or every cubic foot for a gas or water meter. The microprocessor **38** includes a counter-circuit (not illustrated) which is energized by the signal on line **36** to enable the microprocessor **38** to store therein utility usage-related information. Instead of a pulser, an encoder or other means can be utilized to generate data to the microprocessor **38** which is indicative of utility usage.

The microprocessor can also store therein information related to the utility meter **11** with which it is associated. For example, the microprocessor can store therein information related to the user's account number and the identity of the particular meter being read. An inductive coil **40** is provided which can be sealed within the module **14** and which can have a signal induced therein which is directed along line **42** to the microprocessor **38** to program the microprocessor with information relative to the particular meter and user with which the microprocessor **38** and module **14** is associated. In addition, the coil **40** can be utilized to program module **14** to effect operation of the module **14** either in the NEWLY INSTALLED MODE or NORMAL TRANSMISSION MODE. The pulser **34**, inductive coil **40**, and the microprocessor **38** can be similar to that disclosed in the Sears U.S. Pat. No. 4,463,354, entitled "Apparatus for Communicating Utility Usage-Related Information from a Utility Usage Location to a Portable Utility Usage Registering Device," which patent is incorporated herein by reference. In addition, the operation of the meter module **14** is more fully disclosed in the Sears U.S. patent application Ser. No. 08/119,986, filed Sep. 10, 1993, entitled "Apparatus for Communicating Utility Usage-Related Information from a Utility Usage Location to a Utility Usage Registering Device," which is also incorporated herein by reference.

The microprocessor **38** periodically directs a signal on line **44** to a digital-to-analog converter **46** which outputs the signal to the input **48** of a transmitter **50**. The transmitter **50** includes a crystal oscillator **52**, a crystal **54**, a varacter diode **56**, and an antenna **22**. The crystal **54** oscillates at a predetermined frequency, and the varacter diode **56** can be utilized to tune the crystal oscillator **52** and crystal **54**. The crystal oscillator **52** and related components can preferably be provided on a single synthesizer chip such as MC13176 manufactured by Motorola. A voltage control oscillator (VCO) phase lock loop can be provided on the synthesizer chip to stabilize the output of the transmitter and allow the use of a low cost, stable, low frequency crystal to generate a high frequency signal of identical stability.

The transmitter **50** transmits a first signal indicative of utility usage information, which may include a flag, to the data accumulator units **18** at an accurately controlled fixed frequency. In many cases, the frequency (i.e. the carrier frequency of the transmission signal) is assigned by the FCC, is a very narrow frequency band, and must be accurately controlled so that the frequency does not wander into adjacent frequency bands. The crystal **54** and related components are temperature sensitive and vary in oscillating frequency when subjected to varying temperatures. The microprocessor **38** establishes a signal on the input **48** to the transmitter **50**, which signal is a temperature compensated signal to compensate for the varying temperature of the crystal **54** and related components to enable the crystal oscillator **52** to transmit at an accurately controlled fixed frequency. The signal at the input **48** of the transmitter **50** includes a first component which comprises a rapidly varying stepped voltage for data transfer, and a second component which comprises a slowly varying DC signal established by microprocessor **38** for temperature compensation of transmitter **50**.

The microprocessor **38** includes a look-up table therein which includes data indicative of the correct temperature compensated signal to be directed to the input **48** of the transmitter **50** to effect oscillation of the crystal **54** and output of the transmitter **50**, when the transmitter **50** and its related components are at various temperatures which have been entered into the look-up table. Thus, the transmitter **50** is temperature compensated by the signal input **48** from the microprocessor **38**.

A thermistor **60** is operable to sense the temperature of crystal **54** and transmitter **50** and establishes a temperature signal on line **62** to an analog digital converter **64** which directs the signal along line **66** to the microprocessor **38**. The thermistor **60** provides a temperature signal to the microprocessor **38** which enables the microprocessor to determine

from the look-up table therein the correct temperature compensated signal, dependent upon the actual sensed temperature of the transmitter **50**, to be directed to the transmitter **50** to cause the transmitter **50** to transmit at an accurate predetermined frequency.

In the preferred embodiment, each module **14**, including the transmitter **50**, crystal **54**, and thermistor **60** associated therewith, is "tested" at varying temperatures so that each module **14** can be individually calibrated in the look-up table and each microprocessor can be individually programmed to establish the correct temperature compensated signal at the input of the transmitter **50** when the transmitter is at various temperatures. The temperature compensated signal compensates for the non-linearity of the thermistor **60**, crystal **54**, and other components of the transmitter **50** which are "burned in" and calibrated as a unit. The individual calibration and compensation of each transmitter **50** and associated components allow for the use of lower cost component crystals without degrading the accuracy of the transmitted signal. In addition, to further improve the accuracy of the transmitter **50**, the crystals **54** can be aged before they are utilized in the individual transmitters **50**.

Each of the meter modules **14** is preferably powered by a battery **55** which eliminates the need for an external power source. The battery may be a lithium battery which is capable of powering meter module **14** for many years. In locations where power is readily available, the battery can be replaced by a conventional power supply.

A typical example of a data accumulator unit **18** is disclosed in FIG. **4**. The data accumulator unit **18** is housed in a rugged, heavy gauge enclosure **72** suitable for mounting on a telephone pole. The pole-top mounting ability of the unit **18**, not shown, enables the data accumulator units **18** to be placed at locations which are easily spaced apart and which are locations which would likely receive signals from the meter modules **14**. External to the enclosure is a solar panel **74** and an omni-directional antenna **70**. The data accumulator unit **18** includes a receiver **76** tuned to receive signals from the meter modules **14**, a microprocessor **78**, a modem **20**, a rechargeable battery **80**, and a cellular data phone **22**. An antenna **80** is connected to the cellular phone in a known manner to enable the cellular phone **22** to communicate with the control computer **24**. The rechargeable battery **80** enables the data accumulator unit **18** to not require any attachments to power lines and the cellular phone **22** does not require any attachments to telephone lines to simplify site selection and installation. The rechargeable battery **80** will provide power for several weeks of operation to allow for cloudy periods, and the solar panel **74** will charge the rechargeable battery in a well-known manner via a charging circuit **82**. In general, four hours of sunshine per week will provide adequate power. In the preferred embodiment the data accumulator units **18** are adapted to communicate with the computer on a periodic basis and the control computer **24** can not communicate with each data accumulator unit **18** unless the cell phone of the data accumulator unit **18** has established a communications link with the control computer **24**. This mode of operation consumes much less energy than if the data accumulation unit **18** was constantly "on" looking for a message from the control computer **24**. The utilization of a data accumulator unit **18** which periodically transmits its data and then denergizes its data transfer circuitry until the next periodic transmission allows the unit **18** to be powered by a battery and a solar cell. However, in some cases it may be desirable to establish a two-way communication link with the data acumulator units **18** and this can be acomplished by providing a transmitting-receiving cell phone or an RF link with the control computer.

Each of the data accumulator units **18** is adapted to receive first signals indicative of utility usage from a plurality of meter modules **14** which are within transmission range of the data accumulator unit **18**. The first signals are received by antenna **70** and are directed to the receiver **76**. The receiver **76** includes analog circuitry therein to measure the signal strength of each of the received first signals. The signal strength value of the received first signals is directed from the receiver **76** over line **82** to an analog-to-digital converter **84** which converts the analog signal representative of received signal strength to a digital format. The analog-to-digital converter **84** directs the digital output along line **86** to the microprocessor **78** which then stores in memory **88** the signal strength of each of the received first signals from the meter modules **14**. The received signal strength for each of the signals received by the data accumulator unit **18** from the meter modules **14** can be transmitted via the cell phone **22** to the control computer **24** which then ranks the signal strength for each signal and which then enables and instructs only particular data accumulator units **18** to receive, record and store signals from a particular meter module **14**. The first signals from the meter modules **14** which are received at the data accumulator unit **18** by receiver **76** are directed along line **90** to a demodulator **92** which directs its output along line **94** to the microprocessor **78**. The output of the demodulator on line **94** is indicative of the utility usage-related information and includes such information as user identification, utility usage, and an indication of tamper events which is also stored in memory **88**.

The output of each data accumulator unit **18** is directed over a cellular phone **22** and antenna **80** to the data reduction and control computer **24**. To this end, a plurality of modems **96** are connected to the control computer **24** for receiving signals from the cellular phones **22**. Each of the modems **96** is connected to a telephone line **100** for receiving utility usage-related information from the cellular phones **22** associated with the data accumulator units **18**. While a cellular phone **22** has been illustrated to provide data communication between the control computer **24** and the data accumulator units **18**, other well-known methods of communication, such as telephone lines, RF links, or fiber optic cable, could be utilized to connect the data accumulator units **18** to the control computer **24**.

An alarm sensing mechanism can be easily adapted to function with the system **10** of the present invention. To this end, an alarm **102** can be connected via line **104** to the microprocessor **38** to provide an indication of an alarm condition. The alarm could sense fire, smoke, CO, CO_2, natural gas, or could be connected to a security system. When alarm **102** senses an alarm condition, such as a gas leak, a signal is sent via line **104** to the microprocessor **38**. This signal, indicative of an alarm condition, causes transmitter **50** to immediately transmit an alarm signal indicating the alarm condition and the identification or address of the particular module **14** with which the alarm is associated. The alarm signal from a particular meter module **14** can be received, recorded and stored at all data accumulator units **18** which are within range of the meter module **14** and which receive a first signal from the particular meter module, or can be received, recorded and stored only at the particular data accumulator units **18** which are instructed to receive, record and store signals from the particular meter module.

It should be realized that under normal operating conditions, only enabled data accumulator units will receive, record and store signals from a predetermined meter module. When a flag is included in the first signal from a particular meter module, the first signal will be received, recorded and

stored at all data accumulator units which receive the first signal. Accordingly, if it is desired to have an alarm signal received, recorded and stored by all data accumulator units which are within transmission range of the particular meter module, the alarm signal can include a flag which will allow each data accumulator unit within range of the particular meter module 14 to receive, record and store the alarm signal.

When an alarm signal is received at a data accumulator unit 18, the alarm signal is immediately transmitted to the control computer 24 where an operator of the system can affect the necessary response to the alarm condition. Such response could include sending service personnel, sending fire trucks, police or other security personnel.

While the alarm 102 has been illustrated in FIG. 3 as being connected directly to the meter module 14, it should be apparent that the alarm 102 could be spaced apart from the electric or gas meter 11. In some instances, it may be desirable to space the alarm apart from the utility meter 11. Accordingly, when it is desired to space the alarm from the utility meter, the meter module 14 can be modified by eliminating the pulser and meter interface which is not required for an alarm module. Thus, a separate alarm module, not illustrated, can be provided which is similar to meter module 14 and which would include the alarm 102, the microprocessor 38, and the transmitter 50. The alarm can be located anywhere within the structure 16 and would not operate to transmit utility usage-related information other than the identification of the user (i.e. address or identification number), and the occurrence of an alarm condition. For example, if the alarm 102 is a gas sensor, it may be desirable to locate such gas sensor on the second floor of the residence whereas the utility meter may be located in the basement. It is not necessary to hard wire the alarm 102 to the meter module 14 associated with the utility meter 11. Rather, the alarm 102 is associated with a self-contained transmitter mechanism including the microprocessor 38 and transmitter 50 which transmits upon the occurrence of an alarm condition directly to the data accumulator units 18. If desired, the alarm can periodically transmit a status indicator indicating that the alarm module is operative. In such a manner, the present system can be utilized to transmit not only utility usage-related information, but alarm conditions such as fire, gas and security.

FIG. 5 discloses a simplified flow chart for the operation of the control computer 24. Initially, the data accumulator units 18 transmit data to the control computer 24, as represented at 110. The data includes utility usage related information and an identification of the particular meter module 14 from which the data was received. The control computer first determines at 120 whether there is a flag in the signal transmitted from the data accumulator unit. If a flag is included in the signal, the control computer then determines, at 122, whether an alarm condition is present. If an alarm condition is present, the control computer signals an operator at 124 to take action. The action can include calling police, fire or other safety personnel. If a flag is present and an alarm condition is not present, the control computer goes into an autoconfiguration mode at 126. In this mode, the signals being processed are signals from a module 14 in its NEWLY INSTALLED MODE. In the autoconfiguration mode, the control computer 24 ranks, at 128, signals from each particular meter module 14 by measured signal strength at all the data accumulator units 18 which receive signals from a particular meter module 14. The control computer then enables, at 130, the top ranked (by received signal strength) data accumulator units which receive the strongest signals from a particular meter module 14. The enabled data accumulator units 18, which in the preferred embodiment include three or four top ranked data accumulator units, are then instructed to record and store signals from a particular meter module. All other data accumulator units 18 do not record and store signals from the particular meter module.

If a flag is not present in the data received at the control computer, the control computer 24 directs the received data at 132 to the memory of the control computer. The control computer 24 then processes the received data and billing information is sent at 134 to the utility billing computer 12 which generates bills in a well-known manner. The data in the memory of the control computer 24 can be reviewed at 136 for signal strength, tamper events, battery status, and/or other information which would require action. The control computer displays and reports action items at 138. For example, if a battery status indicator indicates a battery replacement is required, a report can be generated at 138 and a system operator can direct service personnel to correct the problem. If a decrease in signal strength at one of the enabled data accumulator units 18 for a particular meter module 14 is sensed, a report can be generated at 138 which would allow the operator to reconfigure the system by disenabling the particular data accumulator unit 18 which received the decreased signal strength and enabling another data accumulator unit 18 for a particular meter module 14.

From the foregoing, it should be apparent that a new and improved method of communicating utility usage-related information, including meter identification and utility usage data from a plurality of meter modules 14, each of which senses, stores and transmits utility meter-related information from an associated utility meter 11 to a plurality of spaced apart data accumulator units 18 is provided. Each of the data accumulator units 18 receives from a plurality of modules 14 first signals which are indicative of utility usage information associated with the meter module. The data accumulator units 18 further periodically transmit data indicative of some of the first signals received by the data accumulator units 18 to a control computer 24. The method includes the steps of periodically transmitting from each of the plurality of meter modules 14 a first signal indicative of utility usage information, receiving at each of the plurality of data accumulator units 18 a plurality of first signals, each of which is transmitted by its associated meter module 14, storing at each of the data accumulator units in the memory 88 data indicative of utility-related information received by the data accumulator units 18 from some of the first received first signals, transmitting to the control computer 24 data from the data accumulator units 18, and periodically transmitting a flag included in the first signal for a predetermined time period from each of the plurality of meter modules to the data accumulator units 18. The flag can be transmitted for a predetermined period of time when the meter module 14 is newly installed and can be utilized when an alarm condition is sensed to affect each data accumulator unit 18 within range of the meter module 14 to receive, record and store meter-related information and/or an alarm condition.

What I claim is:

1. A method of communicating utility usage-related information, including meter identification data and utility usage data from a plurality of meter modules, each of which senses, stores and transmits utility meter related information from an associated utility meter to a plurality of spaced-apart data accumulator units, each of which receives from a plurality of meter modules a plurality of first signals, each of which is indicative of said utility usage information associated with the meter module which transmits said first signal,

and further periodically transmits data indicative of some of the first signals received by the data accumulator unit to a control computer comprising the steps of:

periodically transmitting from each of the plurality of meter modules a first signal indicative of utility usage-related information;

receiving at each of the plurality of data accumulator units a plurality of first signals, each of which is transmitted by its associated meter module;

storing at each of the data accumulator units data indicative of utility related information received by the data accumulator unit from some of said received first signals;

transmitting to the control computer data from each of the data accumulator units which is indicative of utility usage-related information sensed by said plurality of meter modules; and

periodically transmitting a flag included in said first signal for a predetermined time period from each of said plurality of meter modules to said data accumulator units.

2. A method of communicating utility usage-related information as defined in claim **1** further including the step of:

measuring the received signal strength of at least some of said received first signals at each of said data accumulator units.

3. A method of communicating utility usage-related information as defined in claim **2** further including the step of:

storing the received signal strength of said received first signals for which the received signal strength is measured.

4. A method of communicating utility usage-related information as defined in claim **1** wherein said step of periodically transmitting a flag is performed when said meter module is initially installed at its associated utility meter.

5. A method of communicating utility usage-related information as defined in claim **1** further including the steps of:

filtering data stored at each of the data accumulator units to remove data from redundant first signals received at multiple data accumulator units from a particular meter module; and

storing in said control computer a single set of data indicative of utility usage-related information for a particular meter module.

6. A method of communicating utility usage-related information as defined in claim **1** further including the steps of:

sensing an alarm condition and generating an alarm signal in response thereto;

communicating said alarm condition to said data accumulator units; and

transmitting to the control computer from said data accumulator units said alarm signal.

7. A method of communicating utility usage-related information as defined in claim **6** wherein said step of transmitting a flag is performed when an alarm condition is sensed.

8. A method of communicating utility usage-related information from a plurality of meter modules, each of which senses, stores and transmits utility meter related information from an associated utility meter to a plurality of spaced-apart data accumulator units, each of which receives from a plurality of meter modules a plurality of first signals, each of which is indicative of said utility usage information associated with the meter module which transmits said first signal; and further periodically transmitting data indicative of some of the first signals received by the data accumulator unit to a control computer, comprising the steps of:

periodically transmitting from each of a plurality of meter modules a first signal indicative of utility usage-related information;

receiving at each of the plurality of data accumulator units a plurality of first signals, each of which is transmitted by its associated meter module;

storing at each of the data accumulator units data indicative of utility related information received by the data accumulator unit from some of said received first signals; and

transmitting to a control computer data from each of the data accumulator units data which is indicative of utility usage-related information sensed by said plurality of meter modules; and

wherein said step of periodically transmitting said first signal from each of said meter modules includes the steps of periodically transmitting at a first periodic frequency said first signal from each of said meter modules, and periodically transmitting at a second periodic frequency, which is larger than said first periodic frequency, said first signal from each of said meter modules.

9. A method of communicating utility usage-related information as defined in claim **8** wherein said step of periodically transmitting said first signal at a second predetermined frequency is performed for a predetermined time period when each of the meter modules is initially installed at its associated utility meter.

10. A method of communicating utility usage-related information as defined in claim **8** further including the step of:

measuring the received signal strength of at least some of said received first signals at each of the data accumulator units.

11. A method of communicating utility usage-related information as defined in claim **10** further including the step of:

storing the received signal strength of said measured first signals.

12. A method of communicating utility usage-related information from a plurality of meter modules, each of which senses, stores and transmits utility meter related information from an associated utility meter to a plurality of spaced-apart data accumulator units, each of which receives from a plurality of meter modules a plurality of first signals, each of which is indicative of said utility usage information associated with the meter module which transmits said first signal, and further periodically transmitting data indicative of some of the first signals received from the data accumulator units to a control computer comprising the steps of:

periodically transmitting from each of the plurality of meter modules a first signal indicative of utility usage-related information;

receiving at each of the plurality of data accumulator units a plurality of first signals, each of which is transmitted by its associated meter module;

measuring the received signal strength of at least some of said received first signals at each of said data accumulator units;

storing at each of the data accumulator units the received signal strength of said measured first signals received from a particular meter module;

storing at each data accumulator unit data indicative of utility related information received by the data accumulator unit from some of said received first signals; and

transmitting to said control computer data from each of the data accumulator units which is indicative of utility usage-related information sensed by said plurality of meter modules.

13. A method of communicating utility usage-related information as defined in claim **12** further including the steps of:

sensing an alarm condition and generating an alarm signal in response thereto;

communicating said alarm condition to said data accumulator units; and

transmitting to the control computer from said data accumulator units said alarm signal.

14. A method of communication utility usage-related information, including meter identification data and utility usage data from a plurality of meter modules, each of which senses, stores and transmits utility meter related information from an associated utility meter to a plurality of spaced-apart data accumulator units, each of which receives from a plurality of meter modules a plurality of first signals, each of which is indicative of said utility usage information associated with the meter module which transmits said first signal, and further periodically transmits data indicative of some of the first signals received by the data accumulator unit to a control computer comprising the steps of:

periodically transmitting from each of the plurality of meter modules a first signal indicative of utility usage-related information;

receiving at each of the plurality of data accumulator units a plurality of first signals, each of which is transmitted by its associated meter module;

storing at each of the data accumulator units data indicative of utility related information received by the data accumulator unit from some of said received first signals;

transmitting to the control computer data from each of the data accumulator units which is indicative of utility usage-related information sensed by said plurality of meter modules;

periodically transmitting a flag included in said first signal for a predetermined time period from each of said plurality of meter modules to said data accumulator units;

measuring the received signal strength of at least some of said received first signals at each of said data accumulator units;

storing the received signal strength of said received first signals for which the received signal strength is measured;

said steps of measuring and storing the received signal strength of said received first signals are performed at the data accumulator units;

transmitting to said control computer the received signal strength of said received first signals for which said signal strength is measured which is received and stored at each of said data accumulator units;

comparing the received signal strength for each first signal including a flag associated with a particular meter module which first signal is received at a plurality of data accumulator units;

determining and ranking by signal strength which of the plurality of data accumulator units received the strongest first signals for a particular meter module; and

enabling only a limited number of data accumulator units which have received the strongest first signals, including a flag from a particular meter module, to receive, record and store the data indicative of utility usage-related information at a particular meter module.

15. A method of communicating utility usage-related information as defined in claim **14** further including the steps of:

transmitting at a first periodic frequency said first signal from said meter module to said data accumulator units when said flag is not included in said first signal; and

transmitting at a second predetermined frequency, which is larger than said first predetermined frequency, when said first signal from said meter modules to said data accumulator units includes said flag.

16. A method of communicating utility usage-related information as defined in claim **14** further including the steps of:

determining a decrease in strength of said received signal strength at a particular enabled data accumulator unit of the first signals associated with a particular meter module for which the particular data accumulator unit was enabled to receive, record and store said first signals;

disenabling the particular data accumulator unit from storing the first signal from a particular meter module when a predetermined decrease in strength of said received signal strength is determined at said particular data accumulator unit; and

enabling and instructing another data accumulator unit which has been ranked and determined to receive the next strongest received signal strength for the first signal including a flag from a particular meter module to receive, record and store said first signal from said particular meter module.

17. A method of communication utility usage-related information, including meter identification data and utility usage data from a plurality of meter modules, each of which senses, stores and transmits utility meter related information from an associated utility meter to a plurality of spaced-apart data accumulator units, each of which receives from a plurality of meter modules a plurality of first signals, each of which is indicative of said utility usage information associated with the meter module which transmits said first signal, and further periodically transmits data indicative of some of the first signals received by the data accumulator unit to a control computer comprising the steps of:

periodically transmitting from each of the plurality of meter modules a first signal indicative of utility usage-related information;

receiving at each of the plurality of data accumulator units a plurality of first signals, each of which is transmitted by its associated meter module;

storing at each of the data accumulator units data indicative of utility related information received by the data accumulator unit from some of said received first signals;

transmitting to the control computer data from each of the data accumulator units which is indicative of utility usage-related information sensed by said plurality of meter modules;

periodically transmitting a flag included in said first signal for a predetermined time period from each of said plurality of meter modules to said data accumulator units;

transmitting at a first periodic frequency said first signal from said meter module to said data accumulator units when said flag is not included in said first signal; and

transmitting at a second predetermined frequency, which is larger than said first predetermined frequency, when said first signal from said meter modules to said data accumulator units includes said flag.

18. A method of communicating utility usage-related information as defined in claim 17 wherein said step of periodically transmitting a flag is performed when said meter module is initially installed at its associated utility meter.

19. A method of communicating utility usage-related information from a plurality of meter modules, each of which senses, stores and transmits utility meter related information from an associated utility meter to a plurality of spaced-apart data accumulator units, each of which receives from a plurality of meter modules a plurality of first signals, each of which is indicative of said utility usage information associated with the meter module which transmits said first signal; and further periodically transmitting data indicative of some of the first signals received by the data accumulator unit to a control computer, comprising the steps of:

periodically transmitting from each of a plurality of meter modules a first signal indicative of utility usage-related information;

receiving at each of the plurality of data accumulator units a plurality of first signals, each of which is transmitted by its associated meter module;

storing at each of the data accumulator units data indicative of utility related information received by the data accumulator unit from some of said received first signals; and

transmitting to a control computer data from each of the data accumulator units data which is indicative of utility usage-related information sensed by said plurality of meter modules;

wherein said steps of periodically transmitting said first signal from each of said meter modules includes the steps of periodically transmitting at a first periodic frequency said first signal from each of said meter modules, and periodically transmitting at a second periodic frequency, which is larger than said first periodic frequency, said first signal from each of said meter modules;

measuring the received signal strength of at least some of said received first signals at each of the data accumulator units;

storing the received signal strength of said measured first signals;

transmitting to said control computer the received signal strength of at least some of said received first signals which are received by each of said data accumulator units;

comparing the received signal strength for the first signals associated with a particular meter module which first signals are received at a plurality of data accumulator units;

determining and ranking by signal strength which of the plurality of data accumulator units received the strongest first signals from a particular meter module; and

enabling only a limited number of data accumulator units which have received the strongest first signals from a particular meter module to receive, record and store the data indicative of utility usage-related information at the particular meter module.

20. A method of communicating utility usage-related information as defined in claim 19 further including the step of periodically transmitting a flag included in said first signal.

21. A method of communicating utility usage-related information as defined in claim 20 wherein said step of periodically transmitting a flag is performed when said meter module is initially installed at its associated utility meter.

22. A method of communicating utility usage-related information as defined in claim 20 further including the steps of:

sensing an alarm condition and generating an alarm signal in response thereto;

communicating said alarm condition to said data accumulator units; and

transmitting to said control computer from said data accumulator units said alarm signal.

23. A method of communicating utility usage-related information as defined in claim 22 wherein said step of transmitting a flag is performed when an alarm condition is sensed.

24. A method of communicating utility usage-related information from a plurality of meter modules, each of which senses, stores and transmits utility meter related information from an associated utility meter to a plurality of spaced-apart data accumulator units, each of which receives from a plurality of meter modules a plurality of first signals, each of which is indicative of said utility usage information associated with the meter modules which transmits said first signal, and further periodically transmitting data indicative of some of the first signals received from the data accumulator units to a control computer comprising the steps of:

periodically transmitting from each of the plurality of meter modules a first signal indicative of utility usage-related information;

receiving at each of the plurality of data accumulator units a plurality of first signals, each of which is transmitted by its associated meter module;

measuring the received signal strength of at least some of said received first signals at each of said data accumulator units;

storing at each of the data accumulator units the received signal strength of said measured first signals received from a particular meter module;

storing at each data accumulator unit data indicative of utility related information received by the data accumulator unit from some of said received first signals;

transmitting to said control computer data from each of the data accumulator units which is indicative of utility usage-related information sensed by said plurality of meter modules;

transmitting to said control computer the measured signal strength of said measured first signals which are received by the data accumulator units;

comparing and ranking by signal strength the measured first signals associated with a particular meter module which first signals are received at a plurality of data accumulator units;

determining which data accumulator units received the strongest first signals from a particular meter module; and

enabling and instructing a limited number of data accumulator units which received the strongest first signals from a particular meter module to receive, record and store the data indicative of utility usage-related information at the particular meter module.

25. A method of communicating utility usage-related information as defined in claim 24 further including the steps of:

measuring at each of said data accumulator units the received signal strength of said first signals at said data accumulator units which are enabled to receive, record and store the particular first signals associated with a particular meter module;

determining a decrease in strength of a received first signal at a particular enabled data accumulator unit for receiving the first signals associated with a particular meter module;

disenabling the particular data accumulator unit from recording and storing the first signals from a particular meter module when a predetermined decrease in strength of said received signal is determined at said particular data accumulator unit; and

enabling and instructing another data accumulator unit which has been determined to receive the next strongest first signal from a particular meter module to receive, record and store said first signals from said particular meter module.

26. A method of communicating utility usage-related information as defined in claim **25** further including the steps of:

filtering data stored at each of the data accumulator units to remove data from redundant first signals received at multiple enabled data accumulator units from a particular meter module; and

storing at said control computer a single set of data indicative of utility usage-related information for a particular meter module.

27. A method of communicating utility usage-related information as defined in claim **26** further including the step of:

periodically transmitting a flag included in said first signal for a predetermined period of time from each of the plurality of meter modules to the data accumulator unit.

28. A method of communicating utility usage-related information as defined in claim **27** wherein said step of periodically transmitting a flag in said first signal is performed when said meter module is initially installed.

29. A method of communicating utility usage-related information as defined in claim **27** further including the steps of:

sensing an alarm condition and generating an alarm signal in response thereto;

communicating said alarm condition to said data accumulator units; and

transmitting to the control computer from said data accumulator units said alarm signal.

30. A method of communicating utility usage-related information as defined in claim **29** wherein said step of transmitting a flag is preformed when an alarm condition is sensed.

* * * * *

US006181257B1

(12) **United States Patent**
Meek et al.

(10) **Patent No.: US 6,181,257 B1**
(45) **Date of Patent: *Jan. 30, 2001**

(54) **UNIVERSAL UTILITY USAGE DATA GATHERING SYSTEM**

(75) Inventors: **Jean L. Meek**, Lindale; **J. Travis Sparks**, Flint, both of TX (US)

(73) Assignee: **Kemp-Meek Manufacturing, Inc.**, Mineola, TX (US)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/143,713**

(22) Filed: **Aug. 31, 1998**

Related U.S. Application Data

(60) Continuation-in-part of application No. 08/759,068, filed on Dec. 2, 1996, now Pat. No. 5,808,558, which is a division of application No. 08/315,142, filed on Sep. 29, 1994, now Pat. No. 5,602,744.

(51) **Int. Cl.**[7] **G08C 19/16**
(52) **U.S. Cl.** **340/870.01**; 340/870.02; 340/870.31; 340/10.1; 343/866
(58) **Field of Search** 340/870.01, 870.02, 340/870.31, 825.54; 343/741, 742, 788, 866, 867

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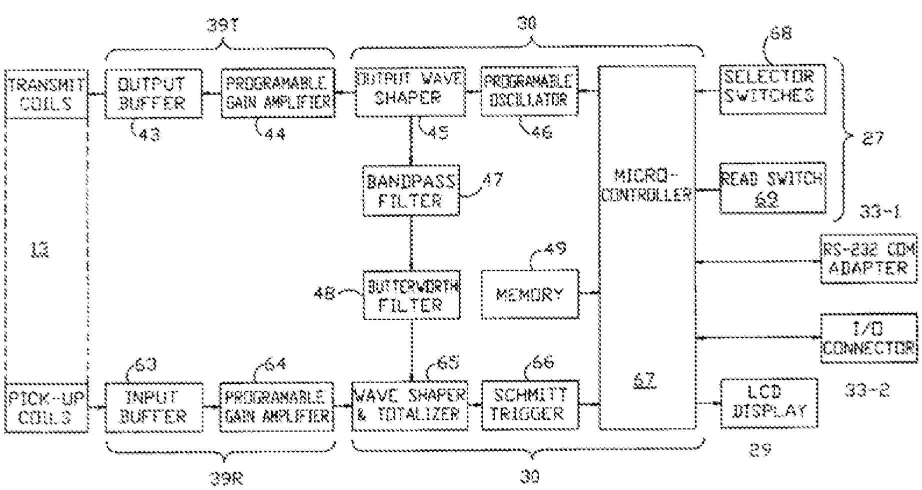
Primary Examiner—Michael Horabik
Assistant Examiner—Timothy Edwards, Jr.
(74) *Attorney, Agent, or Firm*—C. W. Alworth

(57) **ABSTRACT**

A universal utility usage data gathering system that is capable of operating with any other read pad data gathering system, regardless of protocol. The universal system comprises of two components. One—a transponder which is the actual device that accumulates utility usage and will transfer accumulated usage to a reader/interrogator system. Two—the universal reader/interrogator, which will universally read any transponder for which the reader is programmed to accept from the transponder read pad. The universal reader/interrogator is based on standard micro-electronic chips and utilizes a multi-tapped antenna making the device capable of communicating with any transponder. The universal reader/interrogator will determine what protocol from any transponder.

9 Claims, 15 Drawing Sheets

OMNI-PROBE HARDWARE
BLOCK DIAGRAM



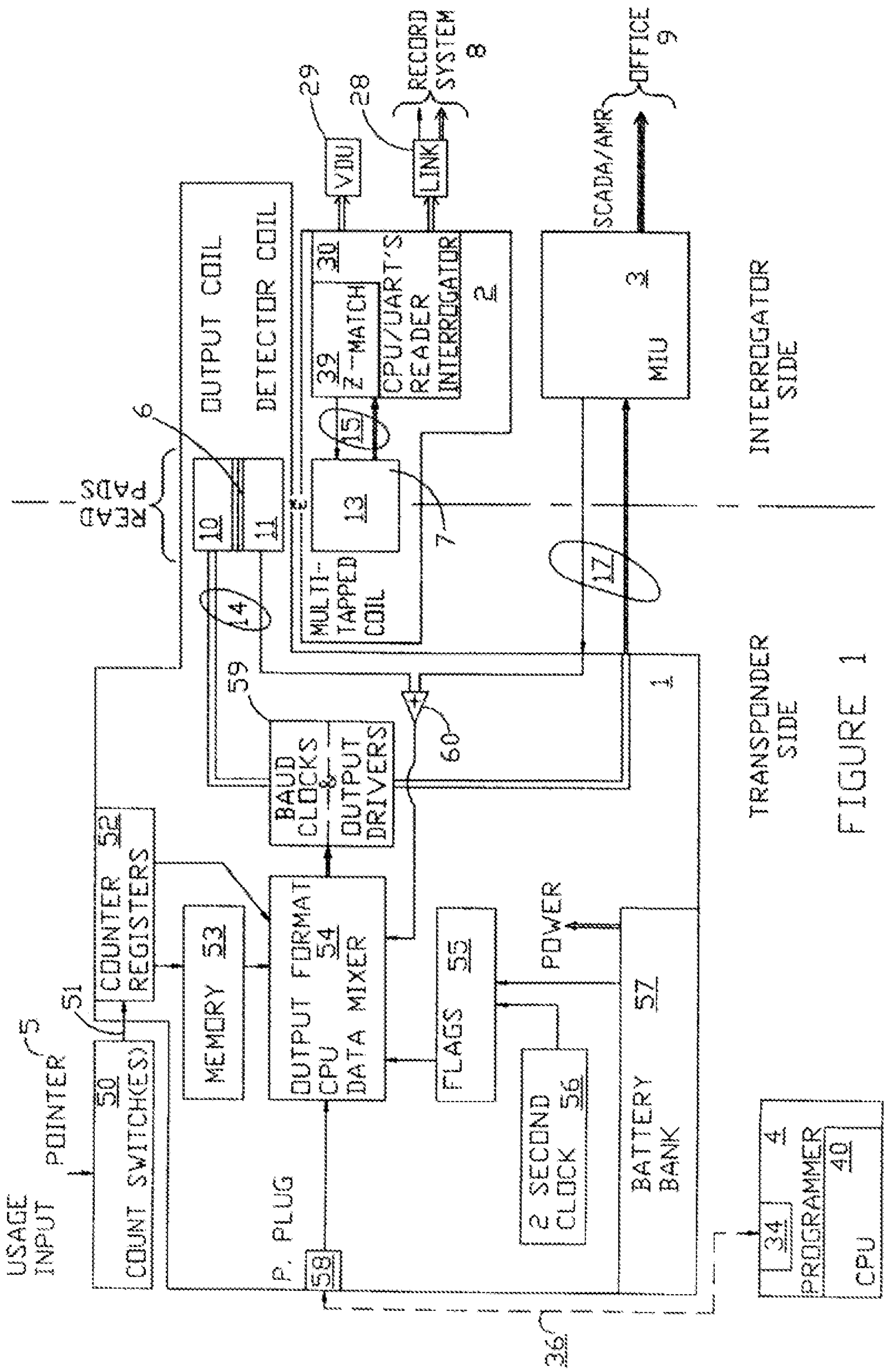

USAGE INPUT
POINTER
5
51
COUNT SWITCH(ES) 50
COUNTER REGISTERS 52
MEMORY 53
OUTPUT FORMAT CPU DATA MIXER 54
FLAGS 55
2 SECOND CLOCK 56
BATTERY BANK 57
POWER
P. PLUG 58
36
34
PROGRAMMER 4
40
CPU
BAUD CLOCKS & OUTPUT DRIVERS
59
60
14
READ PADS
10
11
6
OUTPUT COIL
DETECTOR COIL
13
MULTI-TAPPED COIL
7
15
39
Z-MATCH
30
CPU/UART'S READER INTERROGATOR 2
VDU
29
LINK
28
RECORD SYSTEM 8
SCADA/AMR
OFFICE 9
MIU 3
17
1
TRANSPONDER SIDE
INTERROGATOR SIDE

FIGURE 1

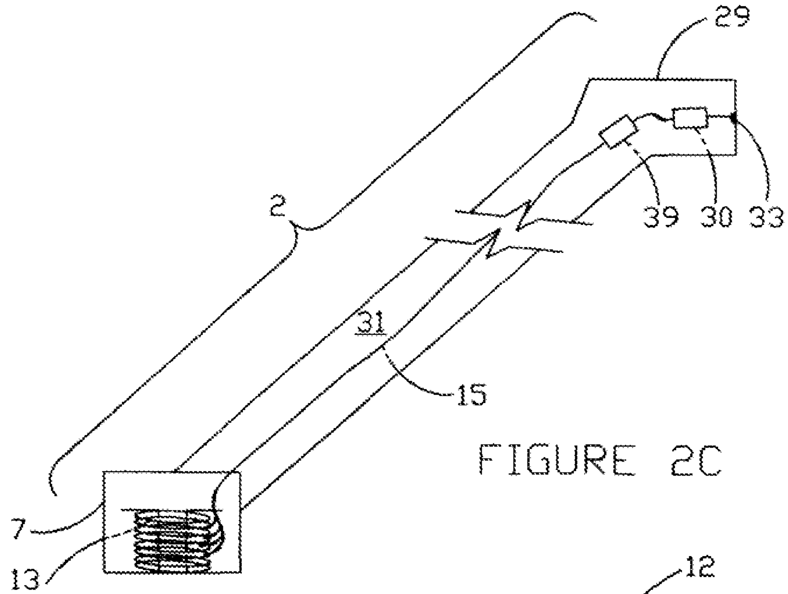


FIGURE 2C

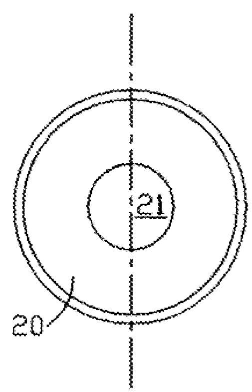


FIGURE 2B

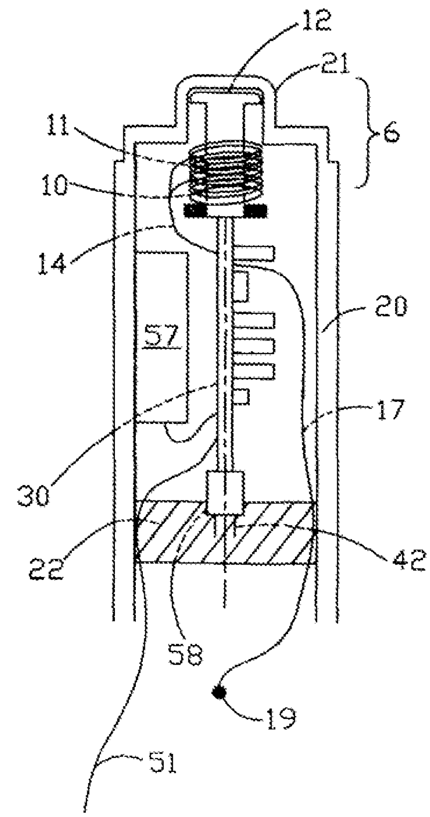


FIGURE 2A

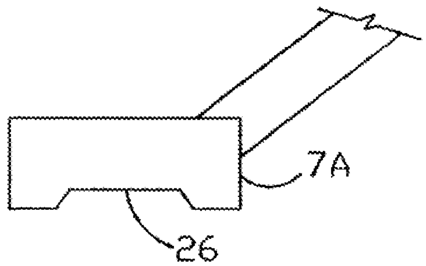


FIGURE 2F

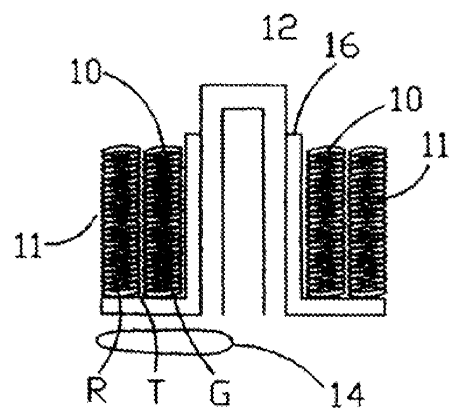


FIGURE 2D

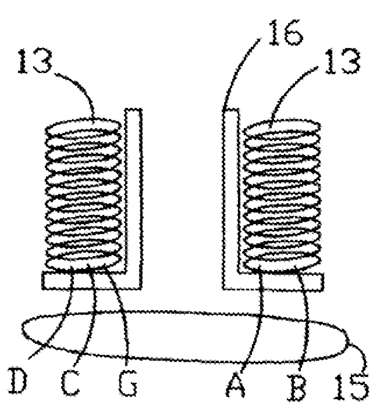
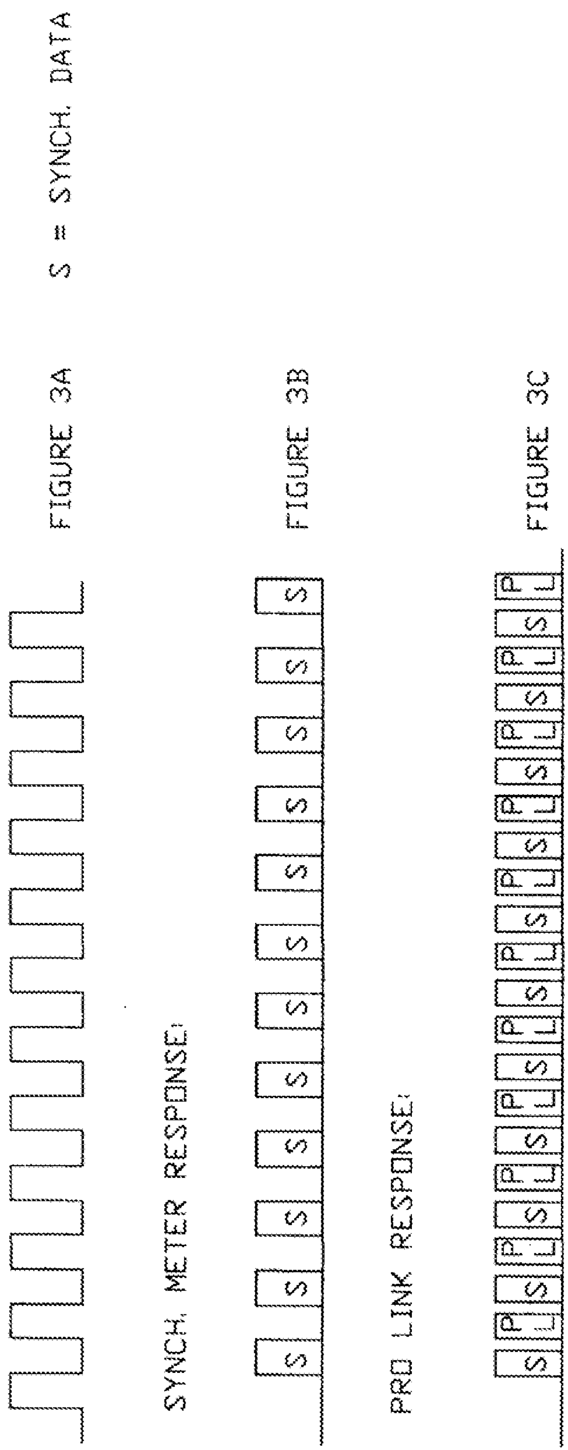
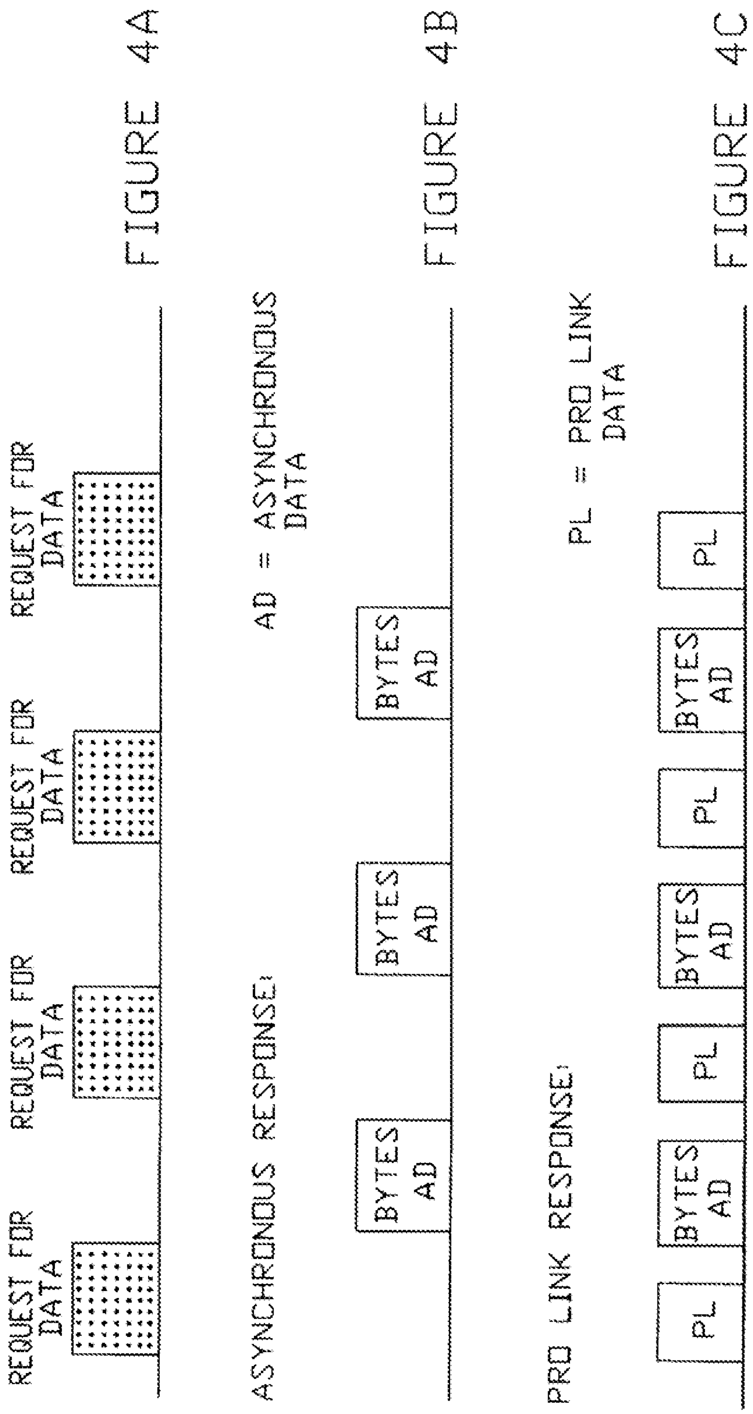


FIGURE 2E


S = SYNCH. DATA
FIGURE 3A
SYNCH. METER RESPONSE:
FIGURE 3B
PRO LINK RESPONSE:
FIGURE 3C


REQUEST FOR DATA
REQUEST FOR DATA
REQUEST FOR DATA
REQUEST FOR DATA
FIGURE 4A
ASYNCHRONOUS RESPONSE:
AD = ASYNCHRONOUS DATA
BYTES AD
BYTES AD
BYTES AD
FIGURE 4B
PRO LINK RESPONSE:
PL = PRO LINK DATA
PL
BYTES AD
PL
BYTES AD
PL
BYTES AD
PL
FIGURE 4C

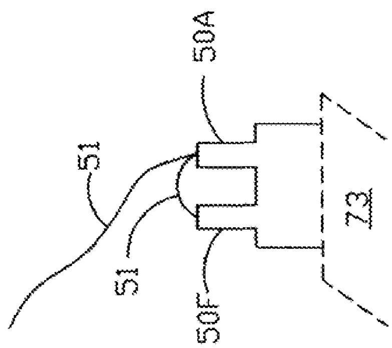


FIGURE 5B

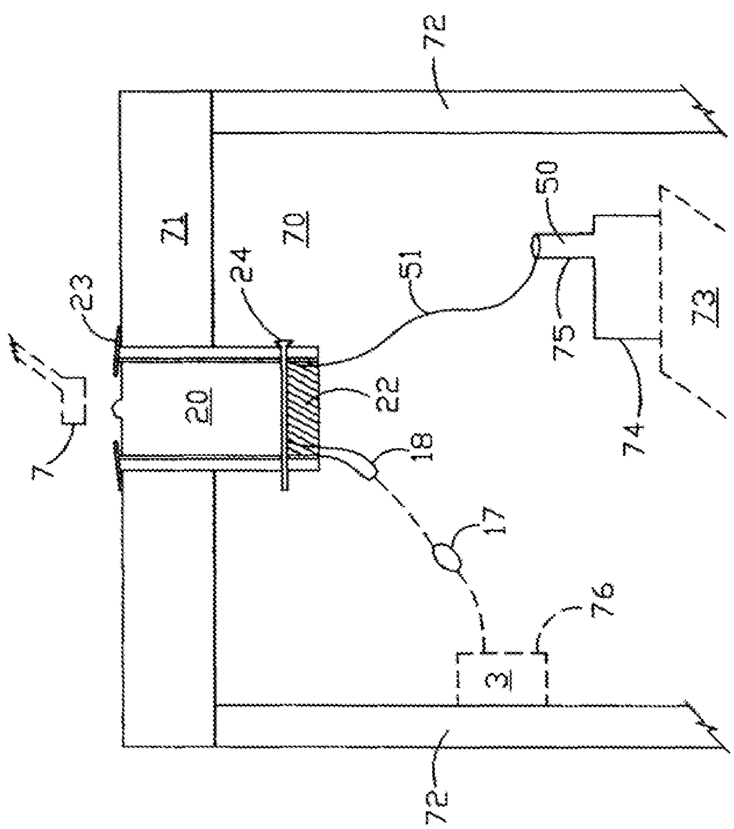


FIGURE 5A

Case 1:18-cv-01683-MN Document 45-1 Filed 11/04/19 Page 241 of 367 PageID #: 701
EXHIBIT 1

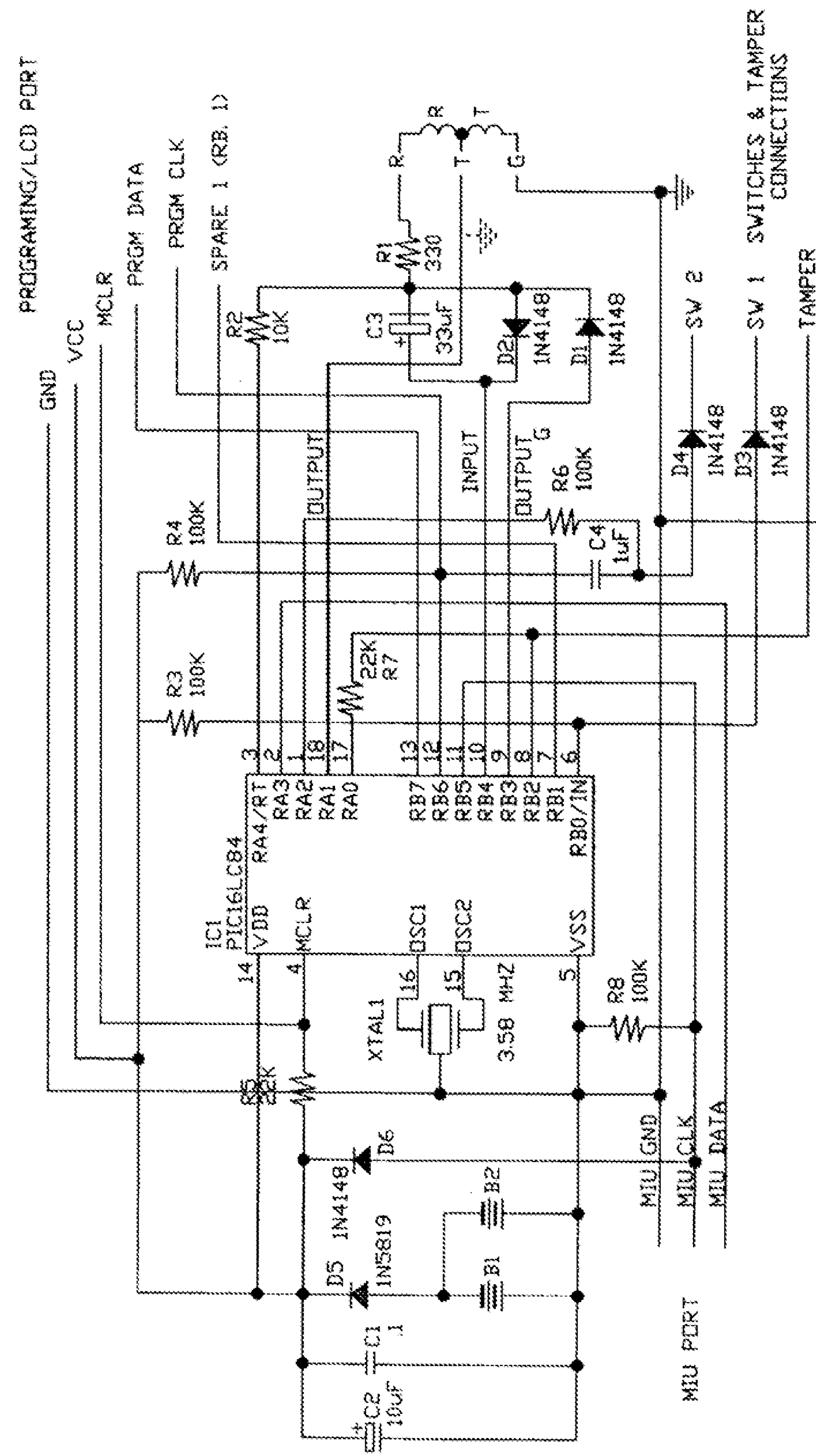


FIGURE 6

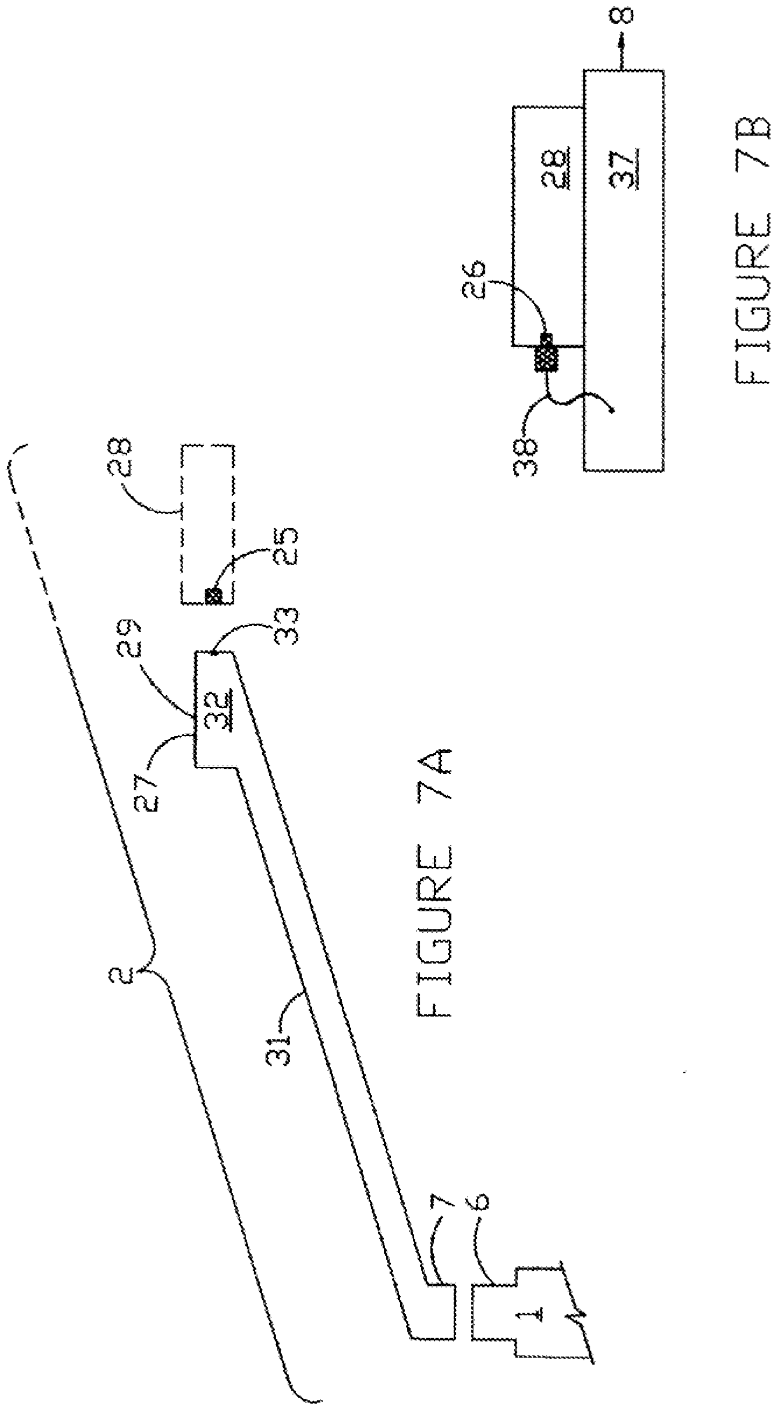


FIGURE 7A

FIGURE 7B

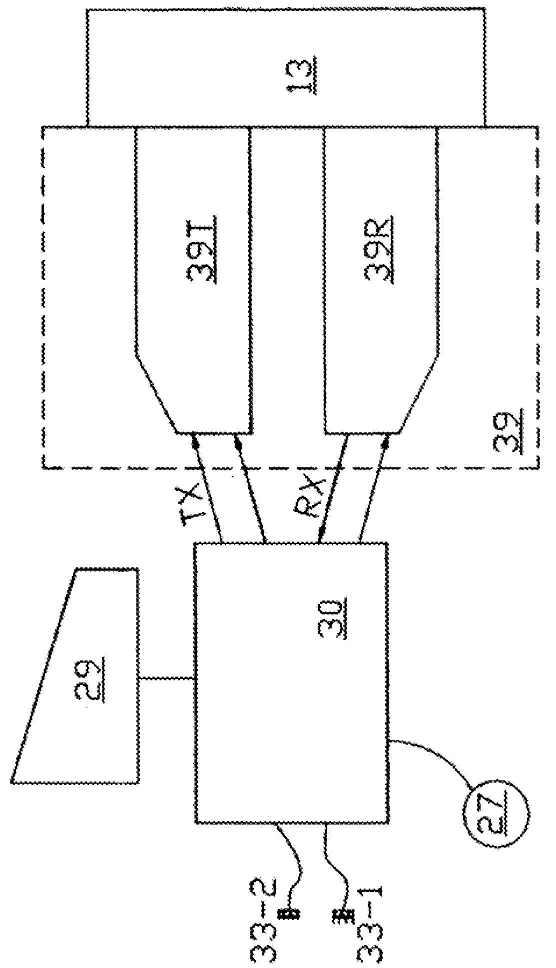


FIGURE 7D

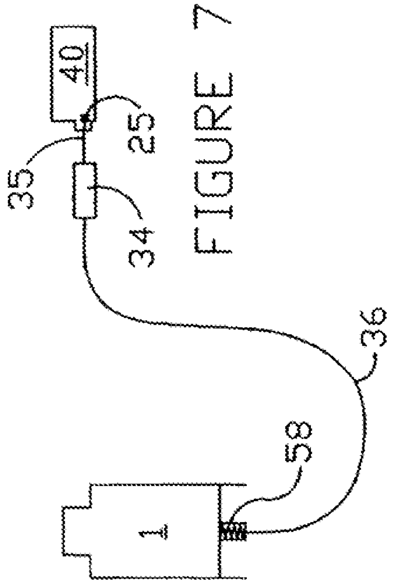


FIGURE 7C

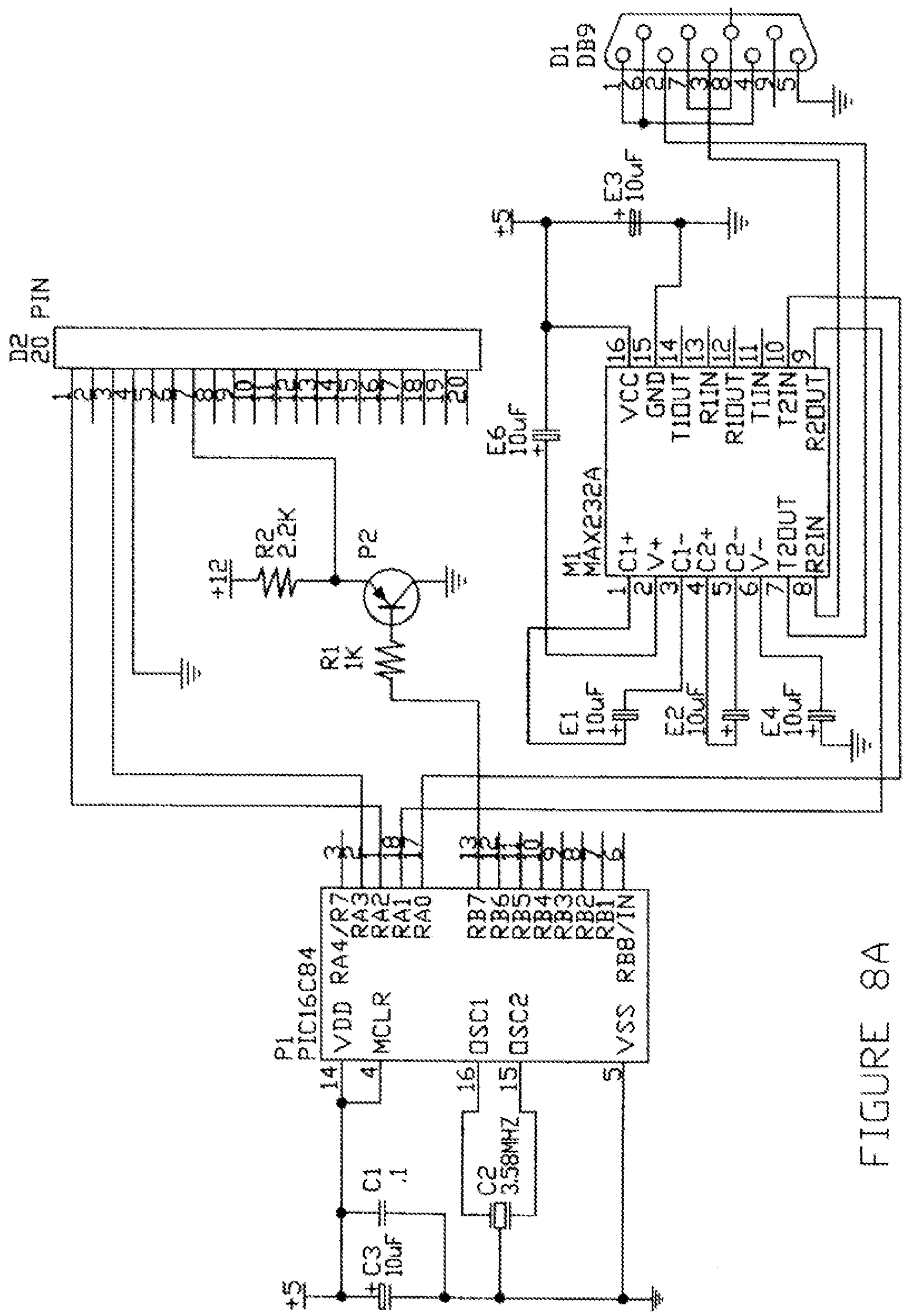

D1
DB9
D2
20 PIN
M1
MAX232A
VCC
GND
T1OUT
R1IN
R1OUT
T1IN
T2IN
R2OUT
C1+
V+
C1-
C2+
C2-
V-
T2OUT
R2IN
E3
10uF
E6
10uF
E1
10uF
E2
10uF
E4
10uF
+5
+12
R2
2.2K
P2
R1
1K
P1
PIC16C84
VDD
MCLR
OSC1
OSC2
VSS
RA4/R7
RA3
RA2
RA1
RA0
RB7
RB6
RB5
RB4
RB3
RB2
RB1
RB8/IN
C1
.1
C2
3.58MHZ
C3
10uF

FIGURE 8A

OMNI-PROBE HARDWARE BLOCK DIAGRAM

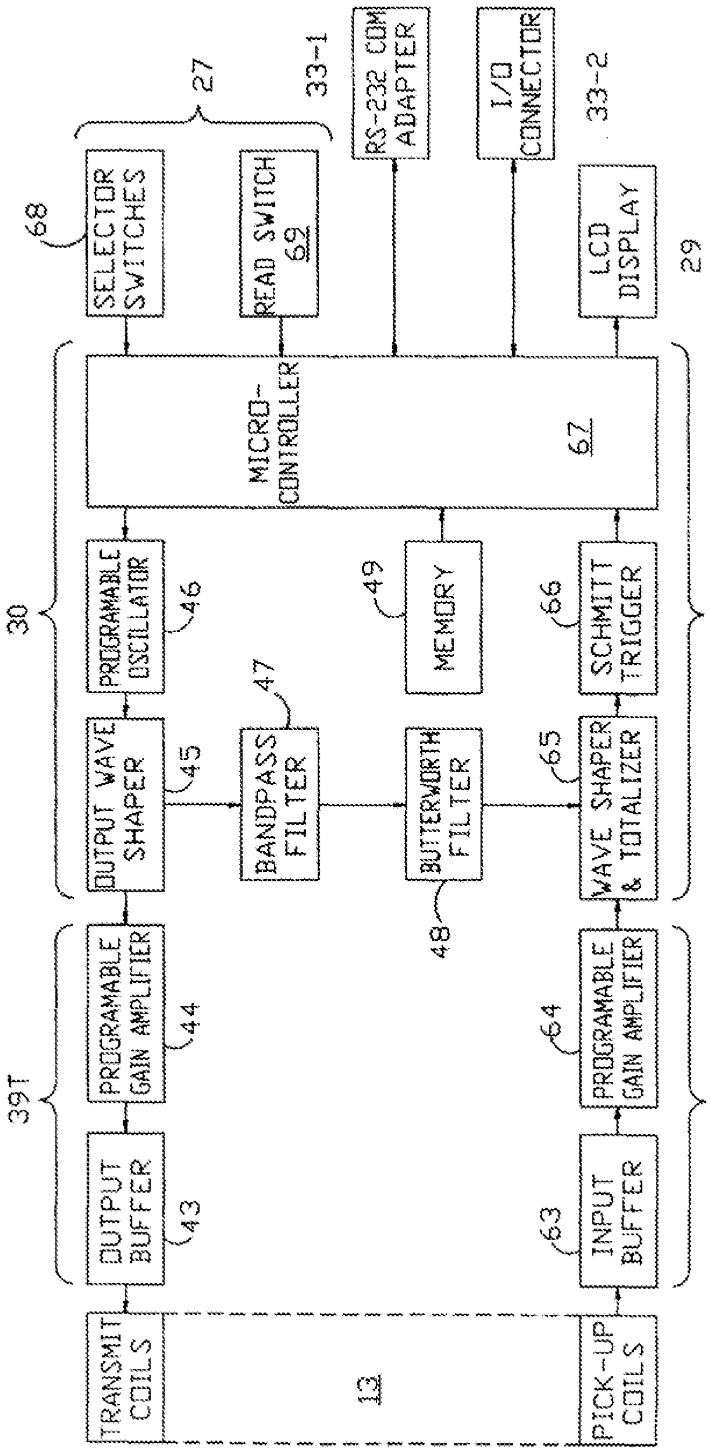


FIGURE 8B

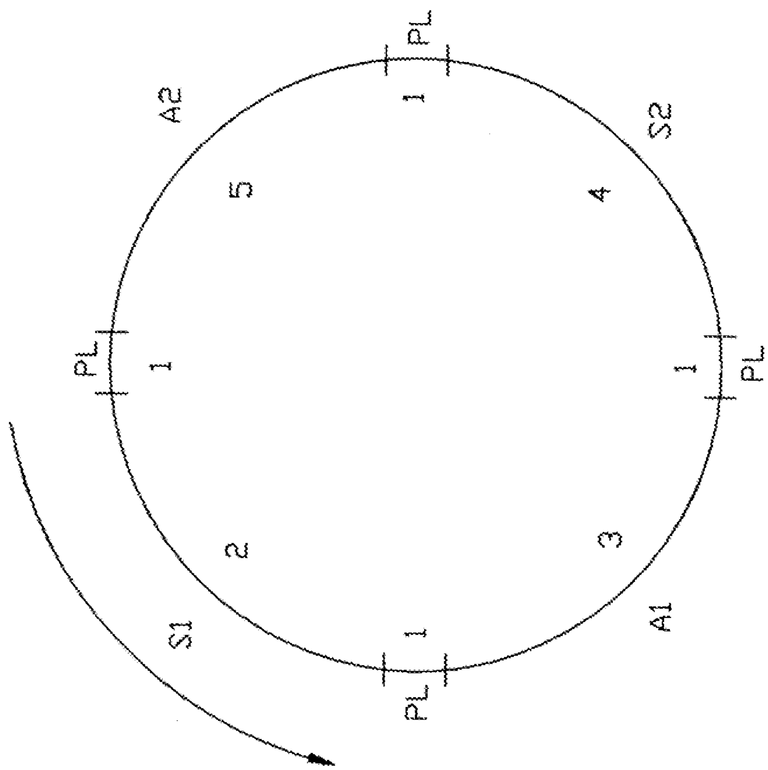


FIGURE 9

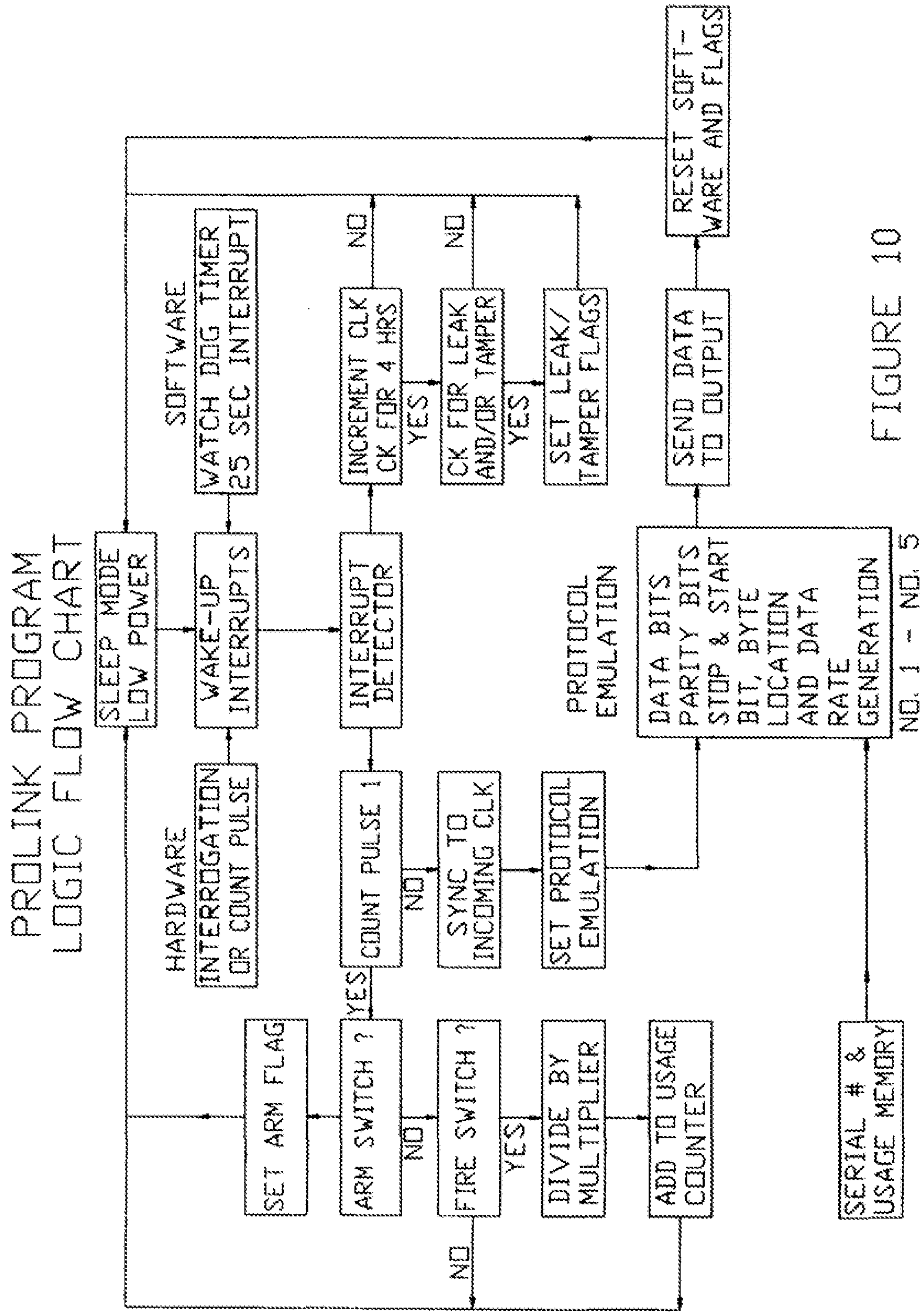

PROLINK PROGRAM
LOGIC FLOW CHART
HARDWARE
SOFTWARE
SLEEP MODE LOW POWER
WATCH DOG TIMER 25 SEC INTERRUPT
WAKE-UP INTERRUPTS
INTERROGATION OR COUNT PULSE
INTERRUPT DETECTOR
INCREMENT CLK CK FOR 4 HRS
NO
YES
CK FOR LEAK AND/OR TAMPER
NO
YES
SET LEAK/ TAMPER FLAGS
COUNT PULSE ?
NO
YES
SYNC TO INCOMING CLK
SET PROTOCOL EMULATION
PROTOCOL EMULATION
DATA BITS PARITY BITS STOP & START BIT, BYTE LOCATION AND DATA RATE GENERATION
NO. 1 - NO. 5
SEND DATA TO OUTPUT
RESET SOFT-WARE AND FLAGS
SET ARM FLAG
ARM SWITCH ?
NO
FIRE SWITCH ?
NO
YES
DIVIDE BY MULTIPLIER
ADD TO USAGE COUNTER
SERIAL # & USAGE MEMORY

FIGURE 10

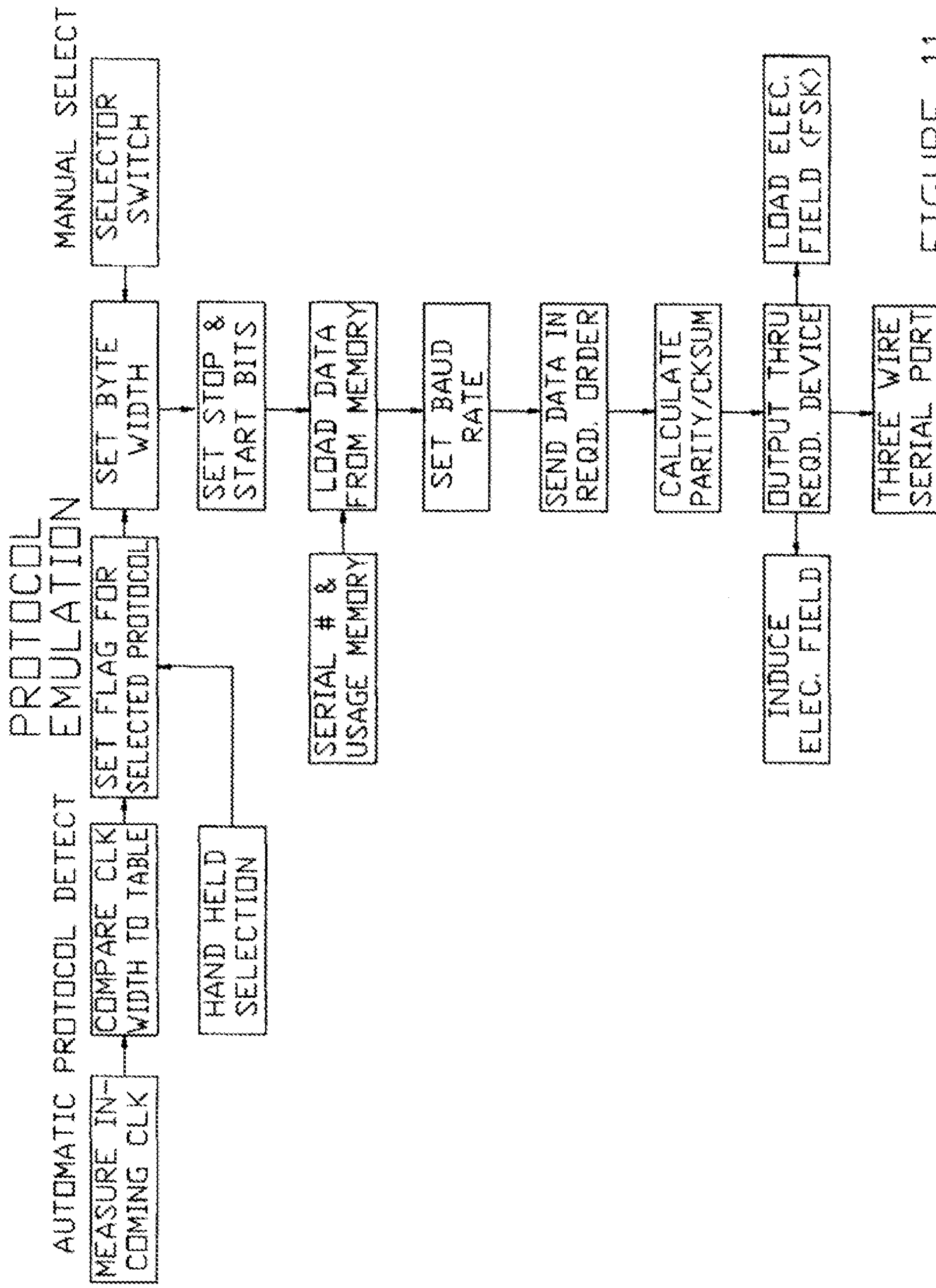

PROTOCOL EMULATION
AUTOMATIC PROTOCOL DETECT
MANUAL SELECT
MEASURE IN-COMING CLK
COMPARE CLK WIDTH TO TABLE
SET FLAG FOR SELECTED PROTOCOL
SET BYTE WIDTH
SELECTOR SWITCH
HAND HELD SELECTION
SET STOP & START BITS
LOAD DATA FROM MEMORY
SERIAL # & USAGE MEMORY
SET BAUD RATE
SEND DATA IN REQD. ORDER
CALCULATE PARITY/CKSUM
OUTPUT THRU REQD. DEVICE
LOAD ELEC. FIELD (FSK)
INDUCE ELEC. FIELD
THREE WIRE SERIAL PORT

FIGURE 11

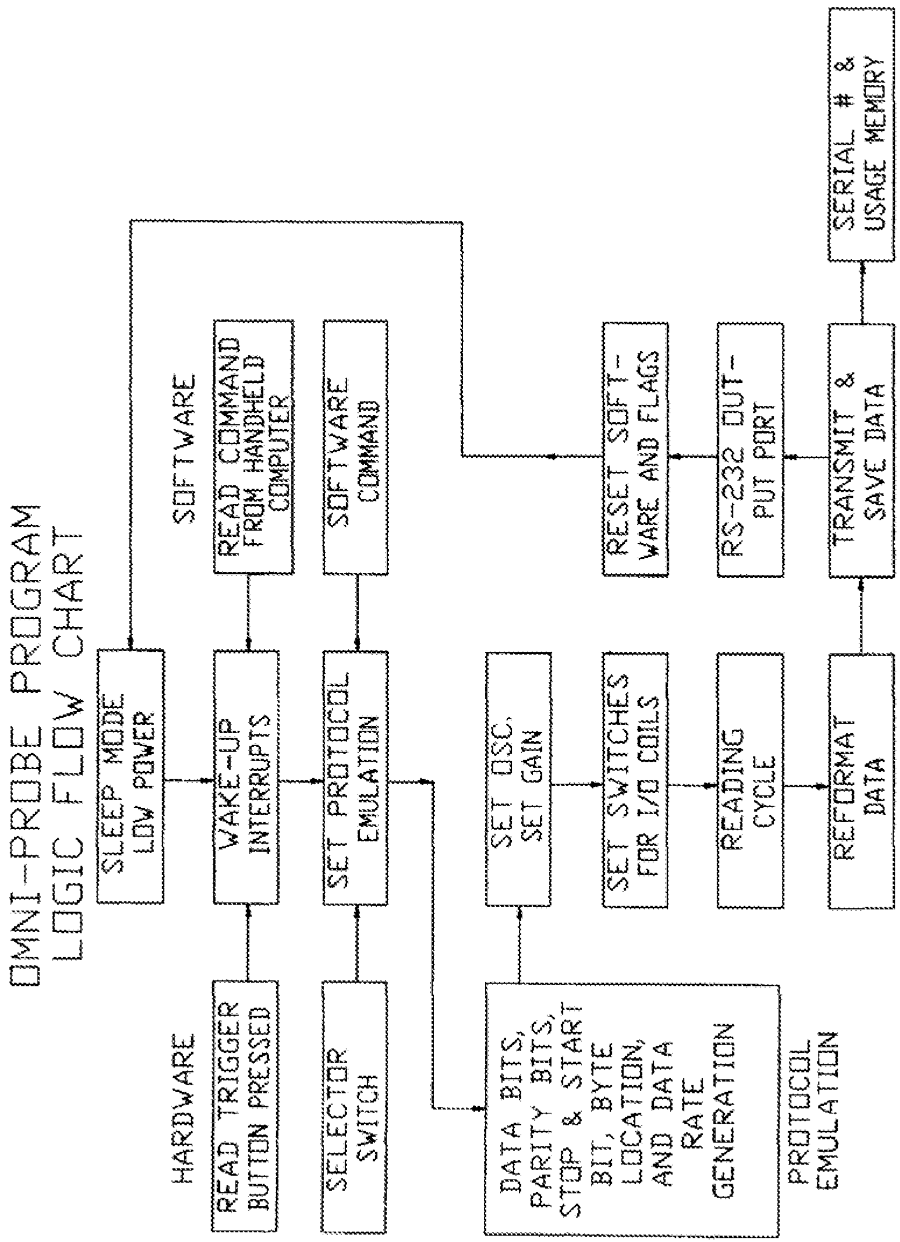

OMNI-PROBE PROGRAM
LOGIC FLOW CHART
HARDWARE
SOFTWARE
READ TRIGGER BUTTON PRESSED
SELECTOR SWITCH
SLEEP MODE LOW POWER
WAKE-UP INTERRUPTS
SET PROTOCOL EMULATION
READ COMMAND FROM HANDHELD COMPUTER
SOFTWARE COMMAND
DATA BITS, PARITY BITS, STOP & START BIT, BYTE LOCATION, AND DATA RATE GENERATION
PROTOCOL EMULATION
SET OSC, SET GAIN
SET SWITCHES FOR I/O COILS
READING CYCLE
REFORMAT DATA
TRANSMIT & SAVE DATA
RS-232 OUT-PUT PORT
RESET SOFT-WARE AND FLAGS
SERIAL # & USAGE MEMORY

FIGURE 12

UNIVERSAL UTILITY USAGE DATA GATHERING SYSTEM

This is a continuation-in-part application of U.S. patent Ser. No. 08/759,068 filed on Dec. 12, 1996 now U.S. Pat. No. 5,808,558 in turn a divisional of U.S. patent Ser. No. 08/315,142 filed on Sept. 29, 1994 now U.S. Pat. No. 5,602,744.

TECHNICAL FIELD OF THE INVENTION

The invention relates to an apparatus and method for metering, storing, transmitting, and recording consumption of a utility; in particular to an apparatus and method that can respond and transmit an emulated usage data signal to readers manufactured by other vendors or universally decipher a signal transmitted by utility usage transponders manufactured by other vendors.

BACKGROUND OF THE INVENTION

The current evolution in electronic devices has made it possible to manufacture utility usage metering systems that store and transmit customer utility usage to a hand-held reader or to a remote data gathering system. These systems generally consist of a some form of mechanical register which meters the actual utility usage coupled to an electronic transponder or a combination electronic register and transponder that sends the utility usage data contained within the register to a reader or remote data gathering system. Utility companies that supply gas, water and electricity have been using a combination of hand-held readers (carried from point to point by a meter-reader), transportable readers (carried in a truck and using radio frequency signals) and remote data gathering systems (transmitted over telephone lines or the like) to record utility usage by commercial customers.

A myriad of manufactures currently produce these utility metering systems with no regard to a standardized usage signal. For example, in the area of water meters, there are two major suppliers mechanical meters and associated electronic transponders and approximately four minor suppliers of mechanical meters which use one of three types of combination electronic register and transponder manufactured by independent minor suppliers. This means that there are at least five different electronic signals, or protocols, which indicate water utility usage none of which are compatible with each other. In reality there are more non-compatible systems, if one includes foreign manufactures and other small domestic manufactures. Looking at the utility metering industry as a whole, one must include electricity and gas meters. These metering systems also have their own data communication protocol.

The problem with non-compatible protocols becomes most acute in water utilities because most of these utility systems are owned by local governments. Thus, once a utility system decides to go to an electronic metering system, that utility system is restricted to a single supplier. Governmental entities do not like to be restricted to a single supplier as improprieties could exist or be suspected by local citizens. For a private utility system, such as a "publicly or privately" held electric or gas company, the single supplier syndrome is not present; however, it would be better for the utility company to have a choice of meter/transponder/reader systems.

Finally, with the age of the "information super highway" incompatible protocols will make the procedure of linking utility usage systems almost impossible. One simple answer

would be for the industry as a whole to devise an industry wide standard similar to the American Standard for Computer Information Interchange (ASCII) used by the computer industry. This will probably happen in the near future, but the cost of retrofitting existing utility usage meters and transponders with compatible transponders will be prohibitively high.

The utility supply industry is actively looking for an approach to "second source" suppliers of meter/transponder/reader systems. Metropolitan (city owned) water systems have demanded that the meter industry provide a means for alternate manufactures to supply devices that can be read or can read existing devices. Some cross licensing between major suppliers has occurred and the market is producing meter reader devices that will read another manufacturer's device; however, the market is not producing a device that will store utility usage and universally respond and transmit data to any manufacture's reader or remote data gathering system.

The instant invention provides a device that will gather water utility usage from a mechanical meter, respond, and transmit a protocol that can be universally read. The device can be installed with new meters or can be easily retrofitted to existing meters. The device therefore satisfies the "second source" requirement. Further, the device can readily be modified to operate in conjunction with any type of mechanically based utility usage meter such as used to meter oil, gas, electricity, steam, etc.

PRIOR ART

The prior must examined from two perspectives:

systems using a hand-held portable reader, and

systems using remote data gathering.

Unfortunately, for the reasons given above, the hand-held systems have been extensively developed for water metering, and gas metering, and electricity metering with no regard to compatibility. The systems are essentially the same, for they are based around a mechanical meter which passes information to an electronic transponder, which then passes data to the hand-held unit. The remote data gathering systems (often referred to as automatic meter reading) have approached the art from a more general view point and consider different utilities.

Utility companies have long recognized the need for direct entry utility usage recordation rather than manually reading a meter, recording the usage, and then transferring the handwritten data to a central billing operation. The initial direct entry systems had a plug on the meter into which an opposite mating plug on a reader was inserted. The reader would then poll the meter, read the position of the mechanical dials and record this reading on paper, magnetic tape, or similar hard data recordation system. The reader was in turn polled at the central office and billing operations continued. The systems which used these mechanical plugs were unreliable because the meter plug would corrode. Systems were then developed to protect the plug but these continued to prove unsatisfactory.

An early effort to use well known electrical principals to eliminate the mechanical plug was disclosed in a 1979 patent to White (U.S. Pat. No. 4,132,981). White discloses a Self-Powered System for Measuring and Storing Consumption of [a] Utility Meter, which uses both mutual inductive coupling and optical coupling, to transfer an interrogation signal from and to send the mechanical position of dials within the utility usage meter to a hand-held reader. The interrogation signal, or wake-up call, is sent to

the utility usage meter via magnetic or mutual inductive coupling. That is, the reader sends an electrical pulse to a reader head which is essentially a coil of wire. The electromagnetic effect causes a time varying electromagnetic field to exist in the general area of the reader coil. The reader head is positioned near a corresponding coil on the meter transponder which senses the electromagnetic field to produce a time varying electric current. This effect is better known as mutual inductive or magnetic coupling. This physical phenomena transfers the electric pulse from the reader head coil to the meter (transponder) coil. This wake-up pulse is of sufficient amplitude that considerable energy is transferred to the transponder. This energy, in the form of electric power, is stored within capacitors and provides power to the transponder. The transferred power allows the transponder to read the position of the mechanical dials and send a synchronized data signal back to the reader which reflects the meter reading.

At the time that White developed his invention, an optical link was chosen to transfer meter data back to the reader. White discloses, but never claims, that the same mutual inductive or magnetic coupling effect could be used to transfer the data signal; however, due to synchronization considerations, optical coupling was the preferred and claimed technique of transferring the data signal. White solved the problem of mechanical corrosion, but the White optical link would become dirty and data transfer could become unreliable.

U.S. Pat. No. 4,758,836 (Sciulli) discloses an Inductive Coupling System for the Bi-Directional Transmission of Digital Data and resolves the problems of White by using mutual inductive or magnetic coupling to transfer both the interrogation pulse and the resulting data signal. Sciulli, like White, uses the "wake-up" pulse to provide power to the transponder and takes advantage of the natural improvement of the electronic art to incorporate other features in the transponder, such as transferring transponder serial number and allowing for reprogramming of the data base within the transponder. The Bi-Directional effect is also used to properly synchronize the data transfer from the transponder to the reader. Again, Sciulli reads the mechanical position of the utility dials.

It should be noted that the inventions of Sciulli and White are assigned to one of the major domestic meter manufacturers. The other major domestic manufacturer of utility meters uses a similar system to transfer usage data and also transmits mechanical dial position. The data is transferred using synchronous transmission techniques. Both systems require a "wake-up" call which is used to energize the transponder. Neither of these systems uses internal (battery) power but relies completely on the power supplied by the interrogation or wake-up pulse. The cost of retrofitting this type of transponder is prohibitively high, because these systems read the mechanical registers in a utility usage meter and a brand new mechanical meter with the necessary read out devices must be used.

Most utility usage meters have a single pointer that is mechanically turned by the use of the utility (the pointer in a fluid meter or the revolving disk in an electric meter) which represents a given minimum use with each revolution. That pointer is turn coupled to mechanical dials which can be read manually. In the case of the two major suppliers of such equipment mentioned above, those mechanical dials are read electrically to give utility usage. The electronic art has progressed to the point that integrated circuit devices use very low power when they are in the quiescent or waiting state. Thus, it is possible to use electronic memory systems to store utility usage rather than mechanical dials by counting each turn of the pointer and storing that information. The electronic register system is readily adaptable to the retrofit market because the transponder need only "see" movement of the existing pointer.

U.S. Pat. No. 4,463,354 (Sears) and U.S. Pat. No. 5,111,407 (Galpern) are among the most recent patents to use electronic usage registers rather than mechanical usage registers. Both disclosures count passes of the pointer and store those counts in an electronic register. Whenever a reader interrogates the transponder, the device responds by sending the current "count" stored in the electronic registers. The reader device (or the office accounting system) knows how much utility usage a "count" represents and the "counts" are then converted into a utility reading. These disclosures use an internal long life (10 years or greater) battery in order to maintain the electronic registers and to be able to "see" the pointer at each turn. These electronic principals are well established in the art. It should be noted that the electronic register devices have yet to be applied to the retrofit market.

In a pure electronic storage transponder, if the battery fails movement of the pointer will NOT be detected and proper indication of utility usage will NOT be recorded in the electronic registers. This is probably the one reason that the two major suppliers of transponders have continued to use devices that read mechanical registers within their meter. If their electronic transponder fails to respond to an interrogation pulse, then utility usage may be manually read by physically looking at the mechanical dials.

These four prior art patents use mutual inductive or magnetic coupling in some manner or another to send an interrogation pulse to the transponder and/or to receive data from the transponder. There are major differences between the four patents. The two major suppliers of transponders (employing mechanical registers) use the initial (and continuing) interrogation pulse(s) to provide power to the transponder; whereas, the minor suppliers (employing electronic registers) must use internal battery power. Each transponder uses a different data transfer protocol and "wake-up" protocol. The two major suppliers of mechanical meter/transponders use synchronous data transmission which requires continuing interrogation pulses, while the minor suppliers of electronic meter/transponders use asynchronous data transmission which requires a single interrogation pulse and the necessary start bits. There are also differences between the two pure electronic register devices mentioned above but these are of minor consequence. Finally all of the suppliers of transponders use different center frequencies. Thus, there is no compatibility between the devices. It is possible to design a universal reader that causes each transponder to send data; however, one supplier's reader would not be able to interrogate another supplier's transponder, unless it were a universal reader. All of these transponders require that the reader coil and the transponder coil be in close proximity to each other (varying from physically touching to several inches apart).

U.S. Pat. No. 5,298,894 (Cerny et al.) discloses a Utility Meter Transponder/Antenna Assembly for Underground Installations. This device uses Radio Frequency signals for the interrogation pulse and for data transmission. The transponder is designed to operate in conjunction with a proprietary electronic meter manufactured by the supplier of the transponder. This particular transponder is a natural extension of the hand-held art in that it now allows the transponder to be interrogated by a hand-held unit at a distance up to 50 feet or by a truck mounted unit at a distance up to 150

feet. In many respects this transponder leans toward automatic meter reading without data lines in that a truck can be driven about the neighborhood polling and recording utility usage.

Remote data gathering systems, commonly called Supervisory Control And Data Acquisition (SCADA) are known in the metering industry as automatic meter reading (AMR) systems and like SCADA systems use data lines (be they telephone pairs, cable systems, optical networks, or the like). SCADA systems are well known in the art and the metering industry has adapted well known and well practiced principals to AMR. U.S. Pat. No. 4,833,618 (Verma et al.) discloses a System for Automatically Reading Utility Meters from a Remote Location. Verma uses a remote data unit coupled to the meter (or meters) to be read which in turn is coupled to a telephone line. The central unit calls the remote unit which turn polls the meter (or meters), converts the data and transmits the data to a central office where is further converted and turned into a utility usage reading for providing billing information. Other prior art in AMR discloses a number of specialized pieces of equipment. In fact, U.S. Pat. No. 5,619,192 (Ayala), filed during the pendency of the parent to this disclosure, describes a utility usage data gathering system but does not describe nor claim the AMR feature using dedicated data lines between a remote meter and a central reader. But, again none of the art is concerned with compatibility as each disclosure uses its own protocol, its own specialized communication hardware, etc.

The major suppliers of mechanical meter/transponders manufacture, distribute and sell AMR systems and one supplier has obtained a license to use the other's data transmission protocol. The AMR system receives the "foreign" data from the foreign meter and converts that data into its own protocol. The foreign data, now no longer strange, is transmitted to the central office where it is read as if that data came from its own transponder. The major suppliers have recognized a need for data interchange but their solution is to employ external data converters rather than directly use the other's licensed protocol.

Thus there remains in the utility usage metering art a series of needs. Users of the equipment require a compatible "second source" transponder; that is, a transponder manufactured by a second supplier that is compatible with the first supplier's transponder. There remains a need for an electronic register transponder that can produce certain information about its internal operation whenever it is interrogated such as potential failure of batteries, electronic registers, etc. There remains a need for a transponder that can be readily retrofitted to existing mechanical metering systems. There remains a need for a transponder that can be directly used in an AMR system without the use of specialized protocol or equipment that is "transparent" to the central office billing operation. Transparency being defined to mean a compatible transponder device or AMR system that can be interrogated and transmit data using a presently installed system without any need for data conversion. And finally, there remains a need for a universal programmable reader that can read any supplier's transponder and output data in a given and particular supplier's emulated protocol; thus, making the universal reader transparent to the office billing operation.

SUMMARY OF THE INVENTION

The instant invention uses modern electronic techniques to form a combination electronic register and transponder which is capable of responding to almost any other manufacturer's interrogation pulse with a buried emulated protocol that tricks the other manufacturer's reader into thinking that it "sees" one of its own meters. The instant invention has its own specialized protocol which provides utility usage information, meter serial number, tamper flag, internal processor condition, battery condition (optional), leak flag, and other critical meter information to its own reader system. The device's protocol contains blank data transmissions; that is, empty time periods in which no information is passed by the device. It is possible to place an emulation of the other equipment manufacture's protocol which sends utility usage data only within these time periods. It is not necessarily possible to provide a universal protocol (that is, a protocol which can emulate all manufacturer's protocols within one data transmission) because signal timing periods would be exceeded and the information transmitted would be in error. The instant invention is specially programmed to send its own protocol plus one or more buried emulated protocols.

In order to be able to emulate almost any manufacturer's system, the instant invention uses two coils (or antennae) rather then the normal single coil used throughout the industry. One coil listens for the single interrogation pulse in the case of an asynchronous system or interrogation pulses in the case of a synchronous system. The second coil is used to send the utility usage information. In some cases the two coils are coupled together to provide antenna "gain". Thus, the device is capable of listening and talking (transmitting) at the same time which is crucial to its operation.

The combination transponder/register system operates in one of three normal modes, which includes a quiescent mode, and in a special program mode. The quiescent mode is the system's most normal mode and uses extremely low power. The quiescent mode monitors two trigger inputs:

the count switch—a switch or a set of switches that detects a single revolution of the usage pointer, and

the detector coil or antenna—the input that determines if a reader is attempting to interrogate the transponder.

Within its quiescent mode, the device briefly wakes up every few seconds to update its internal clock in order to keep track of time. The time clock is used to determine certain operating parameters and system functions which are reported to the reader via the device's specialized communication protocol. (Note—only a special reader can decipher this specialized information.)

Whenever the count switch closes, indicating a minimum utility unit usage, the device responds to the resulting pulse by momentarily "waking-up", incrementing the electronic count register, saving the new value in a non-volatile secondary register and going back to sleep. The device uses two electronic registers, a primary register utilizing RAM and a secondary register utilizing EEPROM. These two registers should always indicate the same utility usage, if they do not, then an error has occurred within the electronic system. Utility usage is properly stored in the EEPROM register and is considered to be very accurate and if the registers disagree, the EEPROM value is used

Whenever current is sensed on the detector coil or antenna; or, if the device is used in an Automatic Meter Reading (AMR) system which incorporates a Meter Interface Unit (MIU), whenever the interrogation command is received, the device wakes up and starts timing the length of the interrogation pulses. After a brief period of time in which the interrogation pulses are timed, the device compares the interrogation pulse times to an internal "look-up table" and decides what sort of reader or MIU system is interrogating the unit. The transponder responds to the interrogation signal based on synchronous or asynchronous communication.

If the interrogator is a synchronous system, then the transponder responds with either an asynchronous data

stream whose starting period is synchronized with the interrogation pulse or a synchronous data stream depending on the reader/interrogator emulation. In the case of asynchronous response to a synchronous reader/interrogator, the total time period of the communication back to the interrogation unit is brief and no timing errors will be introduced. Even though the interrogator is attempting to clock the received signals, those signals are sent in such a manner that the interrogator does not notice that the signals are not being clocked and hence the interrogator is unaware of the discrepancy. It should be noted that if the communication took a long period of time the asynchronous form for an emulated synchronous signal would be seen as invalid by the interrogator.

If the interrogator is an asynchronous system, then the transponder responds with an asynchronous data stream whose starting period is synchronized with the start bits of the interrogation pulse.

It is important to realize that the transponder always responds with its own protocol and intermixes the emulated communication signal within the blank times of the transponder's specialized protocol. In the case of the synchronous emulation, the specialized protocol is sent during the time that the interrogator is sending a clock pulse, and in the case of the asynchronous interrogator the specialized protocol is sent during the time the interrogator is sending a request for data. The intermixed signals are transmitted over the second coil or antenna or to the MIU lines. In all cases the specialized protocol is identical and varies only in respect to baud rate. The response from the transponder is transmitted without regard to further inputs from the interrogator, only the initial pulse widths coming from the interrogator are measured and everything else is ignored. The specialized reader rejects the buried protocol and only accepts its specialized information.

The transponder (which contains the electronic counting and metering circuits) comes in several physical forms or embodiments. The device is available as a 'Pad Read' device only, in that interrogation of the transponder may only be accomplished by a reader/interrogator having transceiver coils or antennae; it is available as a MIU transponder only; and it is available as a combination 'Pad Read' and MIU transponder. The fundamental difference between the embodiments is a transponder with or without a "Read Pad" and the necessary program to allow the transponder to operate in the chosen mode. The first embodiment is for use by small utilities that probably will not use an AMR system. The second embodiment is for use by utilities that have an established AMR system and wish to second source. The third embodiment is for use by utilities that are switching from 'Pad Read' systems to AMR systems. The first embodiment can be converted to the second or third embodiments by a simple programming change and the addition of MIU or serial output lines. Similarly the second embodiment can be converted by a simple programming change and the addition of a 'Read Pad'. Finally, the third embodiment, although available with programming that would allow it to perform either of the function at the same time, is generally supplied with internal programming to perform one or the other function. This choice is made to save internal power.

Finally the combination transponder/register has a programming mode. This mode requires a physical connection. This requirement is deliberate and the physical connection is located within the unit which requires that the unit be opened. This method is unlike the present art, some of which allows for reprogramming through the data coils. If reprogramming of any electronic device is attempted through a communication link, then reprogramming of the communication protocol is not possible. In the instant device the communication protocol can be reprogrammed. Thus, the user can state that the transponder should respond to "A-protocol" and the transponder can then be programmed to produce the specialized protocol with "A-protocol" buried within the data stream. Suppose that the user then wishes to use "B-protocol". The transponder can then be reprogrammed to produce "B-protocol" within the blank times of the specialized protocol. This same programming mode is used to download or change the MIU or 'Read Pad' options explained in the preceding paragraph.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a Universal Send/Receive Utility Usage Data Gathering System as constructed in accordance with the present invention.

FIG. 2A is a cross-sectional view of the container which illustrates the construction and layout of the plurality of coils, the electronic module, battery and other associated components forming the transponder portion of the instant invention.

FIG. 2B is a top view of the container.

FIG. 2C shows the read pad of the associated interrogator and illustrates the layout of the read pad coils.

FIG. 2D is an enlargement of the read pad coils showing how the loops are formed on a plastic loop form.

FIG. 2E shows an alternate reader/interrogator pad which incorporates a guide port as used on certain commercially available reader/interrogators.

FIG. 2F shows a Neptune® reader tip having a corresponding indention.

FIG. 3A depicts synchronous interrogation pulses as found in a mechanical meter/transponder system.

FIG. 3B depicts synchronous response pulses as found in a mechanical meter/transponder system.

FIG. 3C depicts asynchronous response pulses as found in the present invention to the synchronous interrogation pulses of FIGS. 3A and B.

FIG. 4A depicts asynchronous interrogation pulses as found in an electronic meter/transponder system.

FIG. 4B depicts asynchronous response pulses as found in an electronic meter/transponder system.

FIG. 4C depicts asynchronous response pulses as found in the present invention to the asynchronous interrogation pulses of FIGS. 4A and B.

FIG. 5A shows a water meter installation using the instant invention and incorporating a single count switch on the meter.

FIG. 5B shows the preferred embodiment for a dual count switch on the meter.

FIG. 6 is an electrical schematic of the transponder portion of the instant invention.

FIG. 7A shows the reader/interrogator wand for interrogation of the transponder. The drawing further shows the Visual Display Unit and the Optional Data Link Recorder.

FIG. 7B shows the Data Link Recorder in a "cradle" for downloading utility usage information read by the reader/interrogator.

FIG. 7C shows a standard handheld computer in its programming mode employing an additional interface module.

FIG. 7D is a block diagram of the reader/interrogator showing the CPU, the Interface Module and the Tapped Loop Antenna.

FIG. 8A is an electrical schematic of the interface module which converts a standard hand-held computer into a programmer for the instant invention.

FIG. 8B is an electrical block diagram of the interface module which allows the reader/interrogator to transmit and receive data from the tapped interrogator loop antenna.

FIG. 9 is a logic circle diagram showing transponder protocol transmission.

FIG. 10 is an operational flow diagram of the programmed Universal Send and/or Receive Utility Usage Transponder Data Operation in the present invention.

FIG. 11 is an operational flow diagram of the programmed Universal Send and/or Receive Protocol Emulation Data Operation as used by the Transponder and Reader in the present invention.

FIG. 12 is an operational flow diagram of the programmed Universal Send and/or Receive Utility Usage Reader Data Operation in the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The Universal Send/Receive Utility Usage Data Gathering System is shown in block diagram form in FIG. 1. The universal transponder/electronic register is shown generally as item 1, the universal portable reader/interrogator is shown generally as item 2, and the Meter Interface Unit Reader/Interrogator, for connection to central data lines, is shown generally as item 3. As explained previously the Universal Send/Receive Utility Usage Data Gathering System has three general embodiments:

1) a 'Read Pad' device only, in that interrogation of the transponder may only be accomplished by a reader/interrogator having transceiver coils or antennae;
2) a MIU transponder only, in that interrogation of the transponder may only be accomplished by a reader/interrogator having direct wired data lines between the transponder and a MIU interface unit; and,
3) a combination 'Pad Read' and MIU transponder which combines embodiments 1 and 2.

The universal transponder/electronic register, which will be referred to as the transponder, remains fundamentally the same for all three embodiments. The transponder has four input/output functions.

The transponder first receives input information directly from a utility usage meter. In the case of a fluid (gas or liquid) meter, the transponder counts turns of the mechanical pointer which completes one revolution for a given number of gallons (or cubic feet) of water usage. In the case of an electric meter, the transponder counts turns of the spinning disk which completes one revolution for a given number of power units (Watts, Volt-Amperes, Volt-Amperes Reactive, etc.). FIG. 1 illustrates the system as used on a water meter wherein utility input information enters the system from the mechanical pointer, 5, on the water meter (not shown) via the count switch, 50, and associated data line, 51. The system is available with paired count switches arranged as an "Arm" and "Fire" pair, 50A and 50F (not shown in FIG. 1). The paired count switch option is used to resolve the problem of surging in utility usage meters where the pointer swings back and forth under a single count switch. This surging causes multiple counts and a corresponding false indication of utility usage. Although FIG. 1 illustrates the instant device used with a water meter, the same concepts apply with any utility metering system or for that matter with any type of metering system.

The transponder generally is interrogated through one of two input/output (I/O) ports. If the transponder is to be interrogated by a portable reader/interrogator, hereafter referred to as a portable reader, then the transponder read pad, 6, is utilized. If the transponder is to be interrogated by an Automatic Metering system, then the MIU data lines, 17, are utilized. The CPU is programmed to send the I/O data to one of the two ports depending on the embodiment chosen for the transponder.

Finally, the transponder can receive input/output information from the programming plug, 58, which extends from the transponder encapsulated electronic module. The programming plug is a direct connection plug which mates to a standard programming unit, 4 via an interface box, 34. The programming unit should only be used by qualified service personnel to change the internal programming of the transponder central computer unit, the communication protocol, the I/O options, and etcetera. These programming functions will be examined later.

Interrogation and reading of the transponder can be accomplished by two means; a portable reader, shown generally as item 2, or by an Automatic Metering system using a Meter Interface Unit, 3. In either case the interrogation and reading logic is the same; the only difference is the source of the interrogation and the repository of the usage data. The portable reader utilizes a reader read pad, 7, to interrogate the transponder via the transponder read pad, 6, and places the usage data in one of two repositories; a Visual Display Unit, 2A, which is to be read by the meter-reader and manually recorded, or via a Data Link, 2B, into a mechanical recording means, 8 (not shown), for later reading by a central accounting office. The MIU system communicates directly with the transponder via the data lines, 17, and sends the usage data directly back to a mechanical recording means, 9 (not shown), located in the central office for Automatic Metering.

The transponder portion of the Universal Send/Receive Utility Usage Data Gathering System, as shown in FIG. 1, comprises of two physical parts: a encapsulated electronic module contained within an outer plastic container which holds a circuit board plus other associated components, and, if used, the transponder output loop and wake-up loop; and a cable which connects to a single counter switch or a paired counter switch. The physical device is illustrated in FIG. 2A. The circuit board contains all the logic circuits for the transponder. These logic circuits can be individual integrated circuits and associated electronic components or a custom Large Scale Integrated Circuit (LSI). The preferred embodiment for the electronic logic uses a standard low power chip, such as the PIC16LC84, plus additional discrete components as shown in FIG. 6.

The circuit board contains connection ports for the pointer input, 5 and 50; the read pad, 6; the MIU data lines, 17; and the program plug, 58. Included as a part of the electronic module is a long life battery bank, 57, (two cells) which provides base power for all the logic circuits within the electronic module and in particular for the count switch, 51; the RAM and EEPROM based electronic registers, 52; and the 2 second clock, 56. The battery provides power to the CPU, 54; the flags, 55; the output drivers, 59; and other associated electronic circuits on an "as needed" basis. The power approach will become more evident as the electronic design of the transponder is explained.

Referring now to FIG. 2A, the circuit board and its associated electronic circuits are "encapsulated",within a plastic container, 20, to protect the board and the electronics from the environment. Wires are connected to the I/O ports

and the battery power port on the circuit board before encapsulating and are brought outside the encapsulated electronic module for connection to the "outside world". The read pad coils, **10** and **11**, are placed at the closed end of the container with the circuit board on top and the battery, **57**, (or batteries) placed to one side as shown. The programming plug, **58**, is positioned on top of the circuit board at the open end of the container. Standard encapsulating compound is injected into the container so that the container is almost full of the compound. The programming plug extends above the surface of the compound so that electrical connection may be made to the pins, **42**, of the plug; however, sufficient plug body remains within the encapsulating compound to firmly restrain the programming plug. The usage input cable, **51**, extends outside of the encapsulating compound for connection to the input count switch, **50**. If the Automatic Meter Reading (AMR) option is made available, then the MIU data cable, **17**, also extends outside the encapsulating compound. The unterminated end, **19** of the MIU data cable is insulated and terminated.

The transponder read pad, **6**, consists of a multiple-tapped winding which serves as the output coil, **10**, and as the detector coil, **11**. FIG. **2A** shows both the transponder read pad, **6**, and the reader/interrogator read pad, **7**. The transponder antenna system actually comprises of a multiple-tapped winding which forms the two loop antennae of between approximately 600 and 900 turns of #31 wire formed on a plastic loop form, **16**. The actual layout of the winding is shown in FIG. **2D**. A ferrite core, **12**, is inserted within the plastic loop form. The ferrite loop serves to concentrate the electromagnetic field produced in the coil during transmission of data and to aid in producing the single side-band field required by one of the foreign readers manufactured by a major supplier of such equipment under the trade name of Neptune®. If emulation of this particular supplier is not required, then the ferrite core can be left out of the assembly. A manufacturing choice would be to produce the unit with the ferrite core because the requirements of the end user are not known. The ferrite core does not, as stated in the Sears patent, increase the separation distance between transponder and reader/interrogator coils. The core serves to facilitate the transmission of a single side band wave required reader/interrogators supplied by Neptune®. The reader/interrogator antenna is a completely different from the transponder antennae in that it comprises of a multiple-tapped winding, **13**, of approximately 900 turns of #31 wire and does not require a ferrite core. The reader/interrogator loop is shown in FIG. **2E** and has a minimum of four linked loops.

The choice of the number of turns to use in the two antennae is made difficult because of the universal aspect of the transponder and interrogator. In other words, the transponder antennae must closely match the foreign reader and the interrogator must closely match the foreign transponder. In dealing with a match between the instant transponder and its own brand of interrogator the choice of turns is relatively straightforward and about 600 turns on both antennae will match and allow the electromagnetic E-field and H-field components to transfer from one antenna to the other. If one were dealing with ones own transponder/reader and one other foreign transponder or reader, then the number turns would still be about the same.

The reader has essentially infinite power (a re-chargeable battery bank) and switchable gain (to be explained later) which means that the choice of number of turns for the universal reader/interrogator antenna is not critical. In fact the programmed gain circuits will allow the universal reader to read almost any foreign transponder because antenna matching can be programmed into the universal reader logic. The logic program would then select the appropriate gain and circuits so that synthetic loop matching would occur as necessary.

The loop antenna turn problem is compounded by making the instant transponder readable by any (within reason) foreign reader/interrogator. The choice of turns in the transponder must be made to match any (within reason) foreign reader. Programmable matching techniques may be used, but power is required to drive these matching synthesizer circuits. Large amounts of power is not available if long battery life is required. Thus, the manufacturer must make a choice as to which foreign readers (and how many) will be able to interrogate the universal transponder of this instant invention. Experiments have shown that a total 620 turns (310 for the Rx and 310 for the Tx sides of the antenna loop pair) of #31 wire will function for Neptune® and Sensus® emulations. It is known that as the ferrite core is changed in size or as the antenna form is varied in size then the number of turns must be changed. The best way to determine the required number of turns is by trial and error and the use of the Neptune® foreign reader to interrogate the instant transponder. The Neptune® interrogator is the most insensitive reader and, thus, the most sensitive to a variation in antenna turns. Experiments have also shown that a ferrite core of about ½-inches diameter, about ½-inches in length and with a hollow center of about 3/16-inches works best with the tested foreign reader/interrogators. It has also been found that the location of the ferrite core (required for Neptune® foreign interrogators) within the antenna loop is critical and that the best method to determine the proper location is by trial and error using a Neptune® type reader.

As explained above, the transponder loops are encapsulated within the end of the transponder plastic container, whereas the reader/interrogator read pad multiple-tapped loops are encapsulated within their own container and attached to a "wand",**31**, which in turn is attached to the reader/interrogator unit. The transponder plastic container has a elongated tip, **21**, which allows the ferrite core to extend up and into the tip as shown in FIG. **2A**. The Neptune® reader, shown in FIG. **2F**, has a corresponding indention, **26**, which fits over the transponder tip. Other reader/interrogators do not use, nor require, the elongated tip or indention. (Certain Neptune® reader/interrogators include a recessed switch within the indentation. The switch is activated by the elongated tip and causes the Neptune® reader to poll the transponder.) The instant invention's form of reader/interrogator portion of the system and the action of foreign reader/interrogators will later be explained in detail.

The module container extends at least one-half inch past the encapsulating compound and will act to hold an elastomer cap or cover, **22**, in place over the ends of the programming plug by friction between the wall and the cover. The elastomer cover is solely to protect the connection pins, **42**, of the programming plug (or port) from the elements. The programming pins are properly plated but it is best to keep these pins as clean as possible so that the service technician may service the module if and when the need arises. The elastomer is easily penetrated by the pins and forms a separate seal about each pin. When the elastomer is removed the pins are exposed and the small openings into, but not through, the elastomer close back up on their own accord. After the technician is through, the cover is replaced, the pins penetrate the elastomer, and the elastomer once more seals those individual pins. Alternatively, the programming plug can be replaced with a connector that incorporates

a plastic shroud (not shown) which closes over the pins to protect those pins. The art in pin protection is constantly changing and any technique that may be used to protect these programming pins is within the scope intended.

FIG. **5A** shows the actual installation of the Universal Send/Receive Utility Usage Data Gathering System installed in a standard water meter vault, **70**. The standard water vault has side, **72**, and a removable lid **71**. Industry standards now require an opening in the vault lid (supplied with a removable plug—not shown) in which a standard sized vault cylinder, **23**, may be placed. In most water meter installations the vault cylinder holds and protects the read pad coils associated with a transponder at the surface of the meter vault for ready reading by a reader pad (shown as dotted lines item **7**). The present device, **20**, is small enough to fit within the vault cylinder along with its associated read pad. The pointer switch input cable, **51**, is routed to its associated count switch, **50**, which is contained within a copula, **75**, on the meter lens, **74**. (The specially designed meter lens and single copula are the subject of related patent application Ser. No. 29/022,552 and 29/022,561.)

There are two versions for the count switch circuit which are physically and logically different. The first version (as shown in FIG. **5A**) uses a single count switch and associated copula on the lens. This single count switch is subject to "surging"; that is, water pressure pulses can occur in a water system which will cause the usage pointer to vacillate back and forth. This vacillation can sometimes occur when the pointer is located immediately under the count switch and will cause false counts (or usage indication). The alternate and preferred embodiment of the instant invention, shown in FIG. **5B**, uses two count switches separately located in their own copula. The pointer passes under one count switch, **50**A, and "arms" the logic. The pointer then continues its sweep and passes under the second count switch, **50**F, and "fires" the logic. The arm and fire ensure that a proper usage count is taken. Experience has shown that it is best to separate the arm and fire switches by 180 degrees: manufacture of the lens cap is also facilitated by this choice. The angle of separation need only be sufficient to ensure that vacillation of the pointer will not arm and fire the logic.

The electronic module container, **20**, is slipped into the vault cylinder and retrained by a pin, **24**, which passes through openings (not shown) in the vault cylinder. If required and if the proper option is available within the transponder, the MWU termination, **19**, may be opened and the MIU, **3**, spliced into the MIU Data cable, **17**; otherwise, the termination is left alone. Communication leads, **76**, from the MIU are connected to the central office via data lines. The transponder may then be interrogated by whatever option the user desires. Physical installation of the instant invention in electric, gas, or other metering situations would be similar, although a vault cylinder may not be necessary.

Turning now to FIGS. **7A** and **7B**, the universal reader/interrogator subsystem, which will be referred to as the reader will be examined in detail. The universal reader, **2**, consists of three sections coupled together in a platform:

the reader read pad, **7**, the wand, **31**, and display housing, **32**,

which further contains

the reader logic, **30**,

read pad driver/reader electronics, **39**,

the display, **29**, and

a communication ports, **33-1** and **33-2**.

The wand may be a fixed length wand or be an adjustable telescoping wand and the communication port may use either the 25-pin or the 9-pin RS 232C wired link or the LED link. In its usual embodiment the communication port is supplied with the 9-pin RS 232C link, with the LED link being a manufacturer's option. The 9-pin RS 232C is used because a simple plug to plug converter may readily be obtained to adapt the 9-pin port to a 25-pin port and the communication is a well known standard. (Two ports one using RS-232C and the other LED communications may also be provided.) The telescoping wand is preferred. As explained earlier, the read pad incorporates a multiple-tapped loop antenna, shown in detail in FIG. **2E**. A schematic block diagram of the electronic circuit is shown in FIG. **8B**.

The platform allows the meter reader to set the type (or manufacturer) of transponder to be interrogated and then to interrogate the chosen type of transponder by pressing a key after the read pad is placed near the transponder. Due to the high gain circuits used in platform it is not necessary to touch the transponder read pad, even if transponder happens to be of the Neptune® type. (Neptune® reader/transponder systems, as previously explained, use a particular form of FSK that requires the manufacturer's interrogator read pad to physically touch the transponder's read pad.

Thus, the universal reader/transponder can "read" or interrogate practically any transponder. In the United States, there are several manufacturers trading under the names of Sensus®, Neptune®, MasterMeter®, Hexagram®, Kent™, plus other names. Each manufacturer uses its own protocol and methods of communicating between its reader and its transponder. All manufacturers have one point in common between reader and transponder. The transponder communicates with its reader using electromagnetic waves launched from a coil or winding within the transponder, unless the meter is part of an Automatic Meter Reading (AMR) system. (AMR systems utilize hard wired transmission lines, telephone lines, cell-phone transmissions, PCS transmissions, or similar dedicated data transmission lines.)

When the transponder itself is launching or receiving an electromagnetic wave, the transponder coil or winding acts as a receive or transmit antenna for the universal reader/interrogator depending on the "mode" of the transponder. (I.e., is the transponder waiting for an interrogation signal from the reader, or is it sending data to the transponder?)

Because each manufacturer furnishes its own transponder reader, the transponder manufacturer is not concerned about matching its reader to different transponders and uses a single coil in both its reader and transponder. The universal system must be capable of matching to various transponders and therefore uses a multiple-tapped winding in order to obtain the required match of antenna systems; therefore, the universal reader/interrogator is unique in that it uses a multiple-tapped winding to communicate with any transponder. That transponder may be a single winding transponder such as manufactured by Sensus, Neptune, Kent and others, or the multiple-tapped winding as described in this disclosure.

The internally stored program within the logic system, **30**, then emulates to the selected transponder's protocol and uses standard communication language to send signals out the "TX" line to the coil driver portion, **39**T, of the reader interface module, **39**. The same program listens for a response from the transponder on the "RX" line from the programmable amplifier portion, **39**R, of the reader interface module, **39**.

The reader interface module, **39**, is tied directly to the multiple-tapped reader loop antenna, **13**. The program selects which "taps" on the loop antenna will be used for the selected transponder emulation by sending information to

the TX and RX logic in the interface module. The multiple-tapped loop antenna can and does function as both a receive and transmit antenna at the same time. For example, in emulating a synchronous data transmission, the TX circuit will drive the "A" and "B" lines on the loop with a continuous series of clock pulses which appear to look like the transponder's protocol. In the meantime the RX circuit will listen for a response from the transponder on "D" and "G" lines and combination of "C","D",and "G" lines. In the case of an asynchronous transmission, the logic will send a series of pulses to the transponder and then wait for the reply. Here a number of choices as to how the multiple-tapped antenna will operate can be made. For example, "A" and "B" lines can serve as the transmit antenna and any combination of "C","D",and "G" lines can serve as the receive antenna with the proper gain selected by the logic circuit. A discussion on the choice of number of turns for the reader antenna was held earlier.

Another series of options exist when communicating with transponders because the antenna is multiple-tapped and because the RX and TX circuits can be switched in and out by the logic circuit. As explained previously, a number of transponders require energy input to the transponder at the moment of reading or interrogation which is stored and then used to send the data back. This type of transponder requires a larger "wake-up" call then the instant invention. Thus, the logic controller is programmed to cause the TX circuit to select the full loop antenna of some 900 turns to send the wake up pulse. If the transponder replies with a weak signal, then the logic controller will set the RX circuit to its highest gain and use the entire antenna as a receive antenna.

The hardware for the universal reader/interrogator is shown in block diagram form in FIG. **8**B. The central logic controller for the reader is chosen to be a micro logic chip from the PIC16C84 class. It is not necessary to use a low power chip because ample power is available from rechargeable batteries (not shown). A reasonable choice would be to use the same microchip as used in the transponder so that large order discounts would be available from the manufacturer and so that circuits layouts for both devices would be similar. The Central Processor Unit, **67**, would be made up a plurality of microchips (two or more) in order to obtain the memory storage and calculation power required to operate the reader/interrogator. It is possible to purchase a single microchip, but large order discounts would not be available; plus, the manufacturer would have to maintain additional software/hardware to be able to communicate with a second microchip sub-system.

The CPU (a plurality of micro-chips) would be told what type of reader to emulate by the hardware selector switch, **68**, or by an internally stored program in the optional DOS-based link driver, **28**, to be explained in a later paragraph. The logic is then told when to read a transponder by a second hardware switch, **69**, whenever the user has the reader in the proper position for transponder interrogation. (These two switch functions may be combined, but it is believed that the user would be confused and furthermore it has been discovered that meter-readers prefer a trigger type "read" switch.) The CPU is a capable of communicating via a 232 port or via an LED port. Depending on communication requirements, a UART 232 driver, **33-1**, and/or a UART LED driver, and/or a straight "com" port, **33-2**, may be added. The CPU need only be programmed to accept these drivers using standard procedures. As stated, the CPU contains sufficient memory, **49**, to record up to 1000 transponder readings. (If additional readings are required, an external Data Link, **28**, should be used, or the reader downloaded.) The CPU also directly drives an LCD display unit, **29**.

The "read" trigger and the emulation selection drives a programmable oscillator, **46**, to the proper frequency and rate in order to simulate the chosen emulated reader. The output from the oscillator passes through a wave shaping network, **45**; through a programmable amplifier, **44**, and output buffer, **43**. The amplifier and buffer serve to select the correct number of turns on the reader antenna, **13**, (see earlier discussion) as well as provide impedance matching. Part of the output wave is passed through a bandpass filter, **47**, and a Butterworth filter, **48**, and mixed with the return transponder signal in a wave shaper and totalizer circuit, **65**.

The transponder output signal is picked up by the reader antenna, **13**, and passed through the input buffer, **63**. The buffer selects the correct number of turns and serves to provide impedance matching. The buffer output passes through another programmable gain amplifier, **64**, and into the wave shaping and totalizer circuit, **65**. The input and output waves are then shaped in a schmitt trigger circuit, **66**, which restores the analog signals to a digital form for input back to the CPU for processing.

As stated, the logic controller, **30**, also serves to store all data readings taken by the reader and drives the display, **29**. The user may manually record the transponder reading from the LCD display or allow that reading to be automatically stored within the logic controller memory bank. At the end of the day, the stored data may be downloaded to a printer or to central office data collection and storage devices via the communication port, **33**.

Power for the logic controller and the interface module is supplied by re-chargeable batteries; generally of the nickel-cadmium type. The location of the batteries and the charging plug are not shown in the figures as this type of technology is well understood in the art; however, the best location is within the display housing. Although the logic control circuits, the memory circuits and the interface module have been described as separate sub-circuits, all of these circuits may be mounted on one board and installed in the display housing.

The platform may be used with a DOS-based hand-held computer, **28**, incorporating a corresponding communication port, **25**, plugged into the communication port, **33**. This option is shown as a series of dotted lines in FIG. **7**A. The hand-held computer may be programmed to the route that a meter reader will follow. Thus, at the start of a route, the hand-held will know that the first meter-transponder is synchronous type S, and that the next several meters are the same. The hand-held will select the reader type and store data at each reading. The hand-held will known when to switch to synchronous type N, if such a meter is on the route or to any other type of meter. For ease of understanding, in this disclosure, "N" refers to Neptune and "S" refers to Sensus. Downloading of stored data will be undertaken in the central office using a cradle, **37**, as shown in FIG. **7**B. The cradle is connected to the central office data collection and storage computers, **8**. These same central storage computers can re-program the hand-held for the next day's route.

The universal reader/interrogator employs similar logic as does the universal transponder. The reader logic is shown in FIG. **12** and is relatively self explanatory. The reader is generally in a low power sleep mode. Two inputs will wake the reader up; pressing of the read trigger switch or a software command from the Data Link computer. The emulation protocol then follows. The protocol is set by the selector switch or by the Data Link computer. Once the protocol is set, the logic chooses the correct emulation logic (shown in FIG. **11**, which is the same as the logic used by the Transponder and will be discussed with the

Transponder); drives the programmable oscillator; sets the programmable amplifier gains (input and output); collects and stores the data from the transponder. The CPU logic would go onto to reformat the data and transmit it to the optional Data Link (if attached). The software protocol emulations 1 through 5 would function as Type N, Type S, Pro linK, and two other types of standard transponder protocols. These emulations may be set (or modified) at any time using standard computer programming and linking techniques.

Because the reader uses the same logic program as does the transponder, the reader is capable of polling a transponder and determining what type of transponder is responding to the wake-up call. Thus, another embodiment of the universal reader will not require the operator (or the hand-held) to tell the reader what sort of signal to expect. It has been observed that all transponders send a series of signals immediately following the wake-up call. Thus, all that is necessary is to use the same concepts employed by the transponder portion of the instant invention to determine the type of foreign transponder that is being polled by the universal reader portion of the instant invention.

Assume that the universal reader has just been turned on and that the meter-reader has reached the first transponder to be interrogated (or read). As previously explained, the "read button" would be pressed, and the interrogator would send a series of wake-up pulses to the transponder. The universal reader, when using the truly automatic selection mode, logically waits for the start portion of the transponder data stream, which is generally a series of clock pulses, temporarily stores (or holds) this stream, and compares this stream to the internal table. When a match is found, a 'protocol flag' is set indicating the type of protocol that is being received.

Now, allow that the transponder replies with a series of clock pulses of the Neptune® type. The universal reader would scroll through the internal table until it finds a match and would set the appropriate 'protocol flag'. It would then send a Neptune® type emulated protocol or, if a license had been obtained, it would send the Neptune® protocol. The universal reader would then store the next portion of the transponder response data stream, which contains the utility usage reading plus other information that the transponder would send.

The content of the stored return information would differ depending on the operating mode of the universal reader. If the universal reader is using emulated protocol, then the response data stream stored by the device would only contain utility usage and transponder serial number. On the other hand, if the universal reader is licensed, in this case by Neptune®, then the device will store all data returned by the transponder which includes utility usage, serial number, and other Neptune® system information. The reasons for this difference in stored return data will be explained.

Once the transponder data has been stored, the universal reader would return to its quiescent state, and the meter reader would move to the next meter. At this time, the "read button" would be pressed, and the universal reader would start its interrogation of this particular transponder.

The same hand-held DOS-based computer, used with the universal reader, can also serve as the programmer unit for the transponder, as shown in FIG. 7C. A special program can be loaded into the platform and the platform will then be able to download and upload information to the transponder using conventional computer techniques. A special Programming Mode Interface Module, **34**, is plugged into the platform's RS 232C port using a data cable, **35**. The module is then connected to the programming plug, **58**, at the back of the transponder via a data cable, **36**. The programming interface module contains a logic circuit, shown in FIG. **8A**, and necessary batteries to allow the RS 232C 5-volt TTL level to function. The module will actually provide power to the transponder during re-programming.

The programmer, **40**, (which as stared is a general purpose hand-held DOS-based computer) can completely re-program the transponder. Thus, if a new vendor or better protocol enters the market, the transponder can be updated. The current state of the art allows for certain reprogramming but the Data Link is through the internal communication program(s) stored in the transponder. It is impossible to reprogram a computer's data communication protocol while using that protocol. Hence, the instant device chooses to use a separate programming plug located on the back of the transponder. (As previously stated the plug is protected from the elements by an elastomer cover.) Programming techniques are well established in the art and a qualified individual who understands the PIC16LC84 assembly language can program a DOS-based computer to transfer data to and from the transponder providing a logic flow diagram describing the required functions for the PIC16LC84 (or equivalent) controller is provided. (Such a diagram is shown in FIG. **10** which sets down the logic flow in order to emulate any foreign transponder's protocol.)

The programmer may directly interrogate the transponder and read and reset all internal RAM and EEPROM registers. This means that the transponder may be zeroed or if a replacement meter is needed, the transponder may be set a given preset value of usage units. The ability to so readily reprogram and/or reset the transponder requires security and the programming interface module provides that security. Only a qualified and trusted technician would be granted access to the modules and a renegade meter reader would not be able to reprogram or reset a transponder while on the route. Direct connection of the hand-held DOS-based computer/programmer to the transponder will not allow communication because the transponder operates at 3 volts and these logic levels will not properly register with RS 232C TTL protocol. This interaction will be examined with the functional description of the transponder.

The universal transponder, known under its trade name of "Pro linK" is the true heart of the instant invention and is designed to operate with any reader manufactured by any other (foreign) supplier of electronic meter transponders. The "Pro linK", as previously explained, will respond with its own protocol to its own reader as described above as a universal reader. In other words both the "Pro linK" transponder and its associated reader have the universal function. The "Pro linK" reader, known under its trade name of "OmniprobE", when used with a "Pro linK" transponder will glean much more information from the "Pro linK" transponder than will a foreign reader. A foreign reader will be able to obtain meter serial number and usage count from the "Pro linK". The "OmniprobE" when used on the "Pro linK" will be able to obtain utility usage information, meter serial number, tamper flag, internal processor condition, battery condition (optional), leak flag, and other critical meter information as programmed into the "Pro linK" logic. on the other hand, the "OmniprobE" will generally only be able to obtain serial number and usage count from a foreign transponder. The limitation on the "OmniprobE" is caused by the emulation program. If a proper license were to be obtained from a foreign manufacturer, then the "OmniprobE" would be capable of a complete read of the foreign meter.

A proper license from a foreign manufacturer, as stated in the paragraph above, would no longer require the use of an

emulation protocol for communicating with a particular transponder. This is because the foreign manufacturer would have granted permission to the user or manufacturer of the universal reader ("OmniprobE") complete access to the imbedded data stream required to interrogate and receive data from its particular transponder. When a manufacturer grants a "use license", the universal reader would simply be re-programmed, as previously explained, to use that particular manufacturer's protocol in place of the emulation protocol.

As explained in the summary of the invention, specialized information such as operating parameters and systems functions can only be transferred from a foreign transponder to a reader using the foreign device's specialized protocol; otherwise, because of signal timing problems, only usage data and serial number can be transferred using emulated protocol. Thus, a properly licensed universal reader would be able to obtain additional information from the foreign transponder.

If all or a majority of manufacturers would grant a "use license" for their own protocol to A the user or manufacturer of the universal reader then the device would become a true 'umbrella' reader. From the perspective of the user an umbrella reader means the user is not bound to a single manufacturer for either a transponder or a reader/interrogator; hence, any implication of impropriety would be negated.

The physical layout of the universal transponder has already been described: the logic control, emulation routines and loop antennae concepts will now be examined in detailed. The electric circuit diagram for the transponder is shown in FIG. **6**. The universal transponder is based on the low power PIC16LC84 controller chip manufactured by microchip Corporation. This chip contains all the logic functions, **1**, shown in the block diagram of FIG. **1**, with the exception of the programming plug and battery. Ancillary components are required to make the logic function, such as a crystal (for the clock), diodes, capacitors and resistors. The techniques required to layout, choose and design the fundamental micro-processor based transponder are well established in the industry and will be lightly explained as to the best embodiment. The instant invention may be found in assembly of the components, the use of dual loop antenna, and the method in which the components function.

The microprocessor based system draws its power from two long life 3.0 VDC batteries connected in parallel (battery bank, **57**). The low logic can be sustained for roughly 14 years by these 3.0 VDC lithium based batteries based on calculations made on measured loads. (It should be apparent that this is a calculated average life that could be longer or shorter.) The battery bank is protected by a Schottky Diode **D5** (1N5819) whenever the programming mode, which impresses 5.0 VDC on the system, is used. V_{CC} is further protected by capacitors C**2** and C**1**; C**2** acting as a low frequency filter capacitor and C**1** acting as a high frequency filter. It should also be noted that when the transponder is read by the MIU, TTL voltage levels are used and the Schottky Diode, **D5**, serves the same function. The Schottky Diode also blocks the battery bank when and if an external battery bank is added to the transponder; this option will be discussed later.

The MIU clock pulses are passed to the microprocessor and half-wave rectified by signal diode **D6** (1N4148) and filtered by capacitors C**1** and C**2**. This means that some power can be supplied to the logic circuit by the clock pulses—this concept is well known in the art as scavenging.

In a similar manner, the interrogator wake up call, can be used to scavenge power. In this particular instance, the wake up call (synchronous pulses from Type S and Type N readers or asynchronous start bits from Type A or Type B readers) is "seen" by the receive loop, R. These pulses pass through elements R**1** and C**3** and into the microprocessor at terminal RB**3** where due to the internal structure of the microprocessor rectification occurs. Essentially all CMOS chips are produced with input limiting diodes tied to V_{CC} and ground. If any over driving of an input occurs, the input is clamped to the ground (negative) or to the power buss (positive). The power buss is V_{CC} which is tied to C**1** and C**2**. Thus, the positive diode limiters on the logic act in a similar manner as does **D6** and this rectification coupled with C**1** and C**2** allows for scavenging of power. (Note that although there is a 10K resistor, R**2**, between the R coil and logic input RA**4**/RT, some scavenging of power will occur at this input terminal. Again, sufficient power is scavenged so that very little power need be supplied by the battery to communicate to the reader.

The crystal oscillator circuit and watchdog timer circuit are incorporated within the standard logic circuits provided with the PIC16LC84, or similar microchip. The programming and use of these circuits requires one of ordinary skill in the art and the manufacturer's data hand book for the particular microchip. By design the microchip consumes very low power to count crystal oscillations leading to the 2.5 second wake up. Each watchdog wake-up call results in a clock accumulation leading to a 4 hour cycle at which time additional logic is performed. This particular logic is explained later.

The circuit and logic functions performed about the Receive and Transmit antennae are somewhat complex and depend on the reader/interrogator that is interrogating the transponder. The transponder antennae comprises a tapped loop of about 310 turns per tap, as discussed earlier. The antennae can function independently or as a combination—again depending on the emulation required. In the listening mode, which is always occurring while the microchip is in its low power quiescent mode, the logic and the circuits are set to look at the Receive, R, Loop. Input pulses from the Receive Loop are coupled through R**1** and C**3** to input RB**4** on the chip. The resistor/capacitor combination forms the common "tank" circuit to filter incoming pulse trains. The filter is required so that different types of reader/interrogator read-pulses appear to be the same to the chip. For example one type of reader produces pulses that are almost sine-wave in characteristic, while other readers produce a square wave. The tank circuit forms square waves into an "almost sine-wave" thus all inputs may be treated the same. (As explained above scavenging of the input pulse train for power also occurs at input RB**4**.) Input RB**4** is the "wake-up" port in that whenever a pulse (or sinusoidal wave) appears at this input the chip wakes up and starts performing a series of preprogrammed logic functions.

Part of the signal appearing at the Receive Loop is coupled through a 10K resistor, R**2**, to input RA**4**/RT. The 10K resistor serves to stop any echo that may appear on the pulse(s) sent to input RA**4**/RT. This input serves to count the received (interrogation) pulses and make the determination as to the type of reader that is interrogating the transponder. The actual programmed logic will be explained later.

The transmit function is more complex and first the simplest form of synchronous transmission will be discussed. The type S reader/interrogator is looking for a synchronous data transmission that is correlated with its own clock pulses. (The content of the transmission will be examined in the programmed logic to be explained.) The type S reader requires a voltage to be developed at its own

read pad coil and this can best be done by using the entire loop as the transmit antenna. Thus, with the type S reader communication output data is transmitted from port RB3 of the chip. (This particular logic can receive or transmit from any of its ports depending on the internal program.) The output data passes into the whole antenna via a blocking diode, D1, and into the antenna. Feedback of this output into the input port, RB4, is restricted by another blocking diode, D2. At same time, input port RA4/RT continues to monitor the receive loop for continuing interrogation pulses and synchronization of output data with those pulses. Thus, true duplex transmission is taking place. Type A and B asynchronous transmission is similar in that the whole coil is used for data transmission.

The type N reader/interrogator is probably the most complex form of data transmission. The type N reader requires close coupling of both reader and transponder read pads in order to transmit the single side band data stream. The type N reader transmits a continuous series of sinewave clock pulses and looks at its own loop loading to determine if a data bit is present in the said band. In order to emulate this signal (which is the only signal that requires a ferrite core in the transponder loop) a load must be imposed on the reader loop by the transponder loop. The transponder receive loop continuously monitors the clock pulses coming from the type N reader and again full duplex data transmission is being accomplished.

The type N reader requires a side band shift (similar to FSK) to transmit a data bit which occurs every 16 clock pulses. To transmit a "0" the reader coil needs to be loaded which causes a shift in clock frequency. This shift is interpreted by the reader as a "0". On the other hand if no frequency shift occurs, then the reader interprets the 'non-shift' as a "1". Loading of the reader loop can readily be accomplished by shunting the T portion of the transponder loop. The T connection of the transponder loop is tied to input port RA1 which is normally allowed to "float" thus no current flows through this port. To shunt the T portion all that is required is for the chip to pull this particular port to ground. This decision is made by the logic portion in conjunction with the continuous clock pulses.

The transponder requires some form tamper detection which is simple. The four wire lead, **51**, running from the transponder to the count switch or switches has one lead grounded to the transponder ground at the count switch on the meter lens cap (or in the case of an electric utility meter within the electric meter) and the other end tied to two ports on the microchip. An output port, RA0, is connected to an input port, RA8, via a 22K resistor: the same output/input port pair is connected to ground at the count switch. If the ground is present, which implies no tampering, then the input port will not go high whenever the output attempts to go high. On the other hand, if the ground is not present, which indicates an open lead or tampering, then the input port will go high and this condition will be seen by the transponder logic.

The counter switch or switches (preferred) are couple into the microchip via signal diodes D3 and D4. If a single counter switch is used, then the counter is coupled through D3 to input port RB0/IN. Bias for the counter is supplied by a 100K resistor, R3. When the pointer (or disk) passes under the switch the signal is grounded which causes the input port to drop and be registered by the chip as a count. The count also wakes up the chip which then process to follow its program.

In the preferred embodiment (preferred because the risk of surge counting is minimized) two inputs are required to be communicated to the microchip. The "arm" input is supplied to port RB0/IN as described above and serves to wake-up the logic. The logic then drives output port RA2 high which supplies bias to the "fire" switch via another 100K resistor, R6. When the pointer passes the fire counter switch, the bias is reduced to ground potential. This sharp lowering of the voltage produces a pulse which is coupled through a capacitor, C4, to another input port, RB6. This pulse is the usage count which is registered by the logic. The various assignments given to the input/output (I/O) ports of the microchip are for illustrative purposes only as any I/O assignment may be made with this type of chip. The logic programming need only be told what the assignment is and the computer chip will make any remaining decisions based on its own assembly language.

The remaining circuitry associated with the programming port is self explanatory. The microchip manufacturer's data sheet explains the connections and other requirements in order to be able to download a program and/or operating system to the microchip. Connections to the programming unit (whose circuit has been discussed previously) are made through the terminals noted on the circuit schematic shown in FIG. **6**. One function is not so obvious and that the use of the V_{CC} input. As previously explained, the programmer supplies 5VDC TTL levels to the microchip when it is being programmed. The lithium battery bank is protected by the Schottky diode, D5. This diode can serve another useful function if and when the battery bank is exhausted.

The lithium battery bank is sealed within the transponder module and cannot be replaced if it becomes exhausted after a period of time calculated to be in excess of 14 years. Weak internal batteries cause a slight problem in reading in that the transponder must be woken up several times in order to obtain a proper usage indication. The series of wake-up calls serves to store sufficient scavenged power which the transponder can use to communicate. (Alternately a low battery flag can be used to inform the central office a battery problem.) When the user notes that the transponder has a weak battery condition the user has two options:

1) replace the entire transponder, or
2) add an external sealed battery pack.

The external sealed battery pack is simply another pair of 3.0VDC, type AA, lithium based batteries coupled in parallel. A pair of leads with a terminal that matches the programming plug, **58**, is supplied with the external pack. The elastomer cover, **22**, is removed and the battery pack plug inserted into the programming plug. Silicon grease is used to protect the exposed pins. The battery pack now supplies V_{CC} to the power buss and the Schotky Diode serves to block current flow into the internal (exhausted) battery bank, **57**. The transponder is now set for another 14 years of useful service.

The circuit logic is diagrammed in FIG. **10**. The microchip logic remains in a "sleep mode" most of the time in order to conserve battery life. There are two types of "wake-up" that can occur which activates the complete microchip and causes data exchange to occur, with the corresponding use of power. The simplest of these wake-up calls is driven by the software watch dog timer which wakes the microchip up every 2.5 seconds to increment the internal clock and keep track of time. This time is used within the program to determine internal conditions related to leak detection and will be explained in detail. The other wake-up is hardware driven and comes from a number of input sources, these being:

(a) the count switch or switches,
(b) the tamper connection,

(c) the read pad, and /or

(d) the MIU data lines.

Item (a) is the very usage that the transponder is designed to record and report. Item (b) is simply knowledge that someone or something attempted to tamper with the lead coming from the counter switches. Items (c) and (d) are associated with interrogation of the transponder. The various wake-up interrupts are passed to the interrupt detector where the logic decides if the interrupt was a count pulse (a), communication demand (c and d) or a software watch dog timer.

The software watchdog timer interrupts are the easiest to explain. Every 2.5 seconds the watchdog timer increments the timer, as a result a 4 hour clock is counted up. Every four hours the logic completes two operations:

1) checks for a leak, and

2) checks for a tamper.

Leak detection is simple; the logic looks at the counter register and if no usage has been recorded for the past 4 hours the leak flag is set low. If on the other hand, usage has occurred within the previous 4 hours the leak flag is set high. This process repeats itself every 4 hours. The reader/interrogator is programmed to look for the presence or absence of a leak flag and records that fact whenever the transponder is interrogated. The four hour period is software adjustable (via the programmer) to look for usage only at particular times of the day. For example, a given customer might not expect any usage between midnight and four o'clock in the morning; this time period would be programmed into the transponder.

In a similar manner tamper detection is simple. At each four hour period, the logic drives the tamper output port, **RA0**, high. If the tamper circuit is open, then the tamper flag is set high and will be "read" at the next interrogation of the transponder.

Other similar flags may be programmed into the logic. For example, a flag indicating that the logic controller has gone through a total reset is possible. Battery condition flags may be programmed. These decisions can be made at almost anytime during the life of the transponder because of the ease of reprogramming offered by the programming plug. Hardwired inputs (a), (c) or (d) are treated somewhat differently then the software watchdog inputs in that an external event will wake-up the logic.

The usage data can be handled in one of two ways. The first method (not completely shown in the logic diagram) involves the use of a single usage pulse. A single usage pulse is generated for each turn of the pointer (fluid meter) or spinning disk (electric meter). This single pulse is seen as the "fire switch" in FIG. **10**. (There is no arm switch.) The single pulse wakes up the logic and is passed through a divide by multiplier and added to both the RAM and EEPROM usage counter registers. The logic compares the two registers to see that they are the same and if so the logic goes back to sleep. If the two registers are not the same, then the logic resets itself, sets the RAM counter equal to the EEPROM counter, and sets a problem flag. The problem flag tells the interrogator unit that the logic had to reset.

The second method for recording a usage count is shown in the logic diagram of FIG. **10** and is the preferred embodiment. The logic is straightforward in that the first count pulse comes into the arm port and wakes up the logic. The microchip first determines that it has been awaken by a count pulse. This decision is made by looking at the clock pulse input port, **RA4**/RT, to see if a series of pulses are entering the port, if not then the wake-up call was caused by a count pulse. The logic then sets the arm flag which supplies bias voltage to the fire counter switch as previously described. The logic then waits for the fire counter to close, counts the pulse, passes it through the divide by multiplier and adds the result to the usage counter registers in RAM and EEPROM. The logic checks to see if the two registers are the same and if so the logic circuit returns to its low power quiescent mode. If the registers are not same, reset and problem flag bits are as initiated as previously described.

Referring again to FIG. **10**, the logic required to emulate the protocol of various and sundry reader/interrogators will be examined. As previously explained, a wake-up call received on any of the hardwired inputs is examined by the logic to determine what sort of call has been received by the transponder. If a series of clock pulses for synchronous reader/interrogators, or a series of start bits, is received on input port **RA4**/RT, then the logic knows that a reader/interrogator is polling the transponder. On the other hand, if a series of clock pulses is seen on input port **RB5**, then the logic knows that an MIU is polling the unit. Although not associated with the emulation logic, if a series of clock pulse appears on input port **RB6**, then the logic knows that a programmer is connected to the microchip.

Interrogation of the unit by a reader/interrogator or by an MW results in the same internal logic being used to decide what protocol to emulate and which port to answer on. The choice of which port to answer on is set by which port receives the input series of clock pulses. Note, even an asynchronous start bit can be considered to be a series of clock pulses. The logic remembers where the clock pulses appeared and remembers where to reply; the only decision remaining is to type of response.

Type A asynchronous,

Type B asynchronous,

Type x asynchronous,

Type N synchronous,

Type S synchronous, or

Type y synchronous.

Note that "x" and "y" serve to indicate an unlimited (within reason) number of varieties of types of reader protocols or MIU protocols. Emulation of any protocol requires careful study of the results of the data transmission and trial and error in order to be able to emulate that protocol. Once an emulation has been found, simple and well known programming techniques may be used to program the microchip to recognize a given protocol and transmit an emulated data stream using the methods disclosed herein. Alternately licenses may be obtained from the manufacturer of the protocol and a true protocol may be transmitted to a reader/interrogator or MIU.

Once the logic has decided that the incoming pulse is a series of pulses which indicates that interrogation of the transponder is underway, the logic starts to count the pulses. If it "sees" a continuous stream of pulses, then the interrogation is synchronous. If it "sees" a burst of pulses, then the interrogation is asynchronous. The logic then determines the frequency of the clock pulse or burst of pulses which is used to determine the type of reader/interrogator that is polling the unit. Based on the frequency of the clock pulses, the logic then performs a table look and decides what is interrogating the transponder. The logic has available to it the meter serial number and usage count which it incorporates into its reply to the interrogator. Table look up techniques are well know in the programming art and may be readily undertaken by one skilled in the art.

Once the decision is made as to type of reader the logic must convert usage data and serial number to an understandable code for the interrogator (be it a pad reader/interrogator

or an MIU). This can be done by using a simple repetitive program loop that converts the data into a serial bit stream with the necessary parity and check bit information. The techniques used to determine the program steps required to covert data into a serial bit steam with the necessary parity and bit check information are well established in the art and a person with reasonable skill in the art can readily make such a determination following the logic diagram of FIG. 11. The emulation protocol is used by both the transponder and the reader and will be explained in a later section.

FIG. 10 indicates that the afore described procedure is taken in the boxes labeled Emulation Protocol No. 1–No. 5. It should be noted that more then 5 emulations may be undertaken in the microchip; however, at the present time there are only 2 major protocols and several minor protocols used in the market place. Thus, FIG. 10 correctly indicates a reasonable number of emulations. Emulations 2 and 3 are used for the Type S and Type N synchronous reader/interrogators or MIU's; emulation 1 is used for the Pro linK protocol, really a true protocol whose copyright is owned by the inventor and is readily available for licensed use; and emulations 4 and 5 are reserved for other minor emulated protocols. Emulations 4 and 5 may be programmed into the logic at any time (or changed) by use of the Programmer. The copyright to the emulation protocols is owned by the inventor and is readily available for licensed use.

FIG. 11 shows the logic flow diagram for the emulation protocol; with such a block diagram a person reasonably skilled in the art can program a Micro Logic chip to perform the protocol simulation. As stated earlier, if a software license has been obtain from a given manufacturer, then the exact protocol could be used instead of an emulation. The programming techniques would still be similar. FIG. 11 applies to both the transponder and the reader. For example, the logic would be set to look at hardware switches to decide on which protocol to emulate; these switches are intended to be only on certain embodiments of the reader. Thus, if there are no switches, there would be no input, and the logic would continue. (It is possible to manufacture the transponder with a "set" protocol using mechanical switches.)

In the truly automatic selection mode, as used in the transponder, the logic clocks the input pulses coming from the transponder receive antenna to set a protocol flag. The universal reader has the option of a truly automatic selection mode, and in this case the logic clocks the input pulses (synchronization or start words) being received by the reader antenna or the logic looks at the input coming from the optional reader hand-held computer to set the protocol flag. Again if one or the other input is not present it does not matter. The remainder of the data output operation is straightforward and is set once the type of data transmission is known using table look up. The logic knows if the data stream should go to a loop antenna or a three wire serial port by simple knowledge of the input data stream. Thus the final decision as to where to send the output is readily made.

The transponder logic employs a counting/timing logic operation to determine signal type. The reader, if using the automatic selection option, uses only the timing portion of the logic to determine signal type. For example, in the transponder, and referring to the schematic shown in FIG. 6, part of the received signal appears on microchip input RA4/RT. The RT input is a real time input and the microchip is designed to count whatever clock pulses show up at the terminal. When an interrupt occurs (see previous explanation) the microchip starts counting and timing, after a momentary time period the logic looks at the clock counter and makes a decision as to the type of signal based on the number of counts. A Neptune® reader clock pulse rate is lower then that of a Sensus® reader, whereas the asynchronous readers are much faster and differ among themselves. All that is necessary is to determine a reasonable and short time period and associated number of clock pulses. This can be done by experimentation. Simple look-up procedures are them followed. It should be noted that if the read interrupt is caused by an MIU, then the clock pulse rate seen at the real time terminal, RA4/RT, is zero. It is zero because no MIU pulses are directed to this terminal—the MIU clock enters terminal RB5. Thus, for an MIU read the clock rate determination technique will always show zero to the interrupt. Similarly the timing period/rate can be determined for the reader when it uses the universal option. Here the width of clock pulse (or pulses) coming from the transponder are timed and table look up techniques used.

FIG. 9 is a circle diagram that shows how the emulation protocols and the Pro linK protocols are sequentially transmitted. Once the logic has determined that it is receiving a series of clock pulses, it checks the table to determine the type of response required, and replies with the proper emulation protocol followed by the Pro linK protocol. As previously described, the Pro linK protocol contains more data about the transponder then does the foreign emulation protocols. Furthermore the transponder logic will continue to stream data, using the proper emulation, until the interrogator stops sending interrogation clock pulses. The cessation of clock pulses informs the logic that the interrogator is satisfied. This is a normal manner in which interrogation terminates.

As explained, the logic knows whether to reply on the MIU data line or the read pad data lines based on which input port receives the interrogation clock pulses. This simple logic step means that considerable energy will be conserved because power is not wasted by sending data to unused ports. The scavenging of energy by the techniques described above mean that no (or very little) battery energy is used for communication. This technique extends battery life.

There has been disclosed heretofore in the above discussion the best embodiment and best mode of the present invention as presently contemplated and tested. It is to be understood that the examples given and the circuits given may be changed. Slightly different methods of attachment of assemblies to each other to form the instant invention may be made. Slight changes in use of the equipment may be made by varying the order in which the logic operates. Thus, modifications can be made to this invention without departing from the spirit of the invention and, if such modifications are so made, they should be construed as being within the spirit of the invention which is to provide a truly universal reader/transponder utility usage data gathering system.

We claim:

1. A universal send/receive utility usage data gathering system having a universal reader/interrogator unit and a transponder unit of the Sensus type wherein the transponder contains transponder windings with means for communicating with transponder windings; and includes means for receiving data indicative of utility usage, storing utility usage data, receiving interrogation signal, and responding with transponder data signal; wherein the transponder and universal reader/interrogator are capable of passing radiated electromagnetic signals between each other, comprising:

a) an antenna system, adapted to pass electromagnetic signals, having a first set of windings and a second set of windings;

said first set of windings being a part of the universal reader/interrogator unit having a plurality of taps

coupled thereto and being electrically selectable as to act as a transmit antenna or as to act as a receive antenna, said taps capable of independent selection;
said second set of windings being the transponder windings and wherein,

b) the universal reader/interrogation unit comprises first means for generating transponder interrogation signal and for storing responsive data signal received from the transponder, said interrogation signal being selected by logic circuits within said reader/interrogation unit to match interrogation requirements of the transponder unit, said first means coupled to second means for selection and impedance matching of said first set of windings to act as a transmit antenna, said second means coupled to said plurality of taps within said first set of windings; and further comprising third means for selection and impedance matching of said first set of windings to act as a receive antenna, said third means coupled to said plurality of taps within said first set of windings capable of programmed amplification and wave shaping of said received transponder data signal, and in communication with said first means in which said received transponder data signal is stored.

2. A universal send/receive utility usage data gathering system having a universal reader/interrogator unit and a transponder unit of the Neptune type wherein the transponder contains transponder windings with means for communicating with transponder windings; and includes means for receiving data indicative of utility usage, storing utility usage data, receiving interrogation signal, and responding with transponder data signal; wherein the transponder and universal reader/interrogator are capable of passing radiated electromagnetic signals between each other, comprising:

a) an antenna system, adapted to pass electromagnetic signals, having a first set of windings and a second set of windings;
said first set of windings being a part of the universal reader/interrogator unit having a plurality of taps coupled thereto and being electrically selectable as to act as a transmit antenna or as to act as a receive antenna, said taps capable of independent selection;
said second set of windings being the transponder windings and wherein,

b) the universal reader/interrogation unit comprises first means for generating transponder interrogation signal and for storing responsive data signal received from the transponder, said interrogation signal being selected by logic circuits within said reader/interrogation unit to match interrogation requirements of the transponder unit, said first means coupled to second means for selection and impedance matching of said first set of windings to act as a transmit antenna, said second means coupled to said plurality of taps within said first set of windings; and further comprising third means for selection and impedance matching of said first set of windings to act as a receive antenna, said third means coupled to said plurality of taps within said first set of windings capable of programmed amplification and wave shaping of said received transponder data signal, and in communication with said first means in which said received transponder data signal is stored.

3. A universal send/receive utility usage data gathering system having a universal reader/interrogator unit and a transponder unit selected from one of the Sensus, Neptune, MasterMeter, Hexagram, or Kent type transponders wherein the selected transponder contains transponder windings with means for communicating with transponder windings; and includes means for receiving data indicative of utility usage, storing utility usage data, receiving interrogation signal, and responding with transponder data signal; wherein the transponder and universal reader/interrogator are capable of passing radiated electromagnetic signals between each other, comprising:

a) an antenna system, adapted to pass electromagnetic signals, having a first set of windings and a second set of windings;
said first set of windings being a part of the universal reader/interrogator unit having a plurality of taps coupled thereto and being electrically selectable as to act as a transmit antenna or as to act as a receive antenna, said taps capable of independent selection;
said second set of windings being the transponder windings and wherein,

b) the universal reader/interrogation unit comprises first means for generating transponder interrogation signal and for storing responsive data signal received from the transponder, said interrogation signal being selected by logic circuits within said reader/interrogation unit to match interrogation requirements of the transponder unit, said first means coupled to second means for selection and impedance matching of said first set of windings to act as a transmit antenna, said second means coupled to said plurality of taps within said first set of windings; and further comprising third means for selection and impedance matching of said first set of windings to act as a receive antenna, said third means coupled to said plurality of taps within said first set of windings capable of programmed amplification and wave shaping of said received transponder data signal, and in communication with said first means in which said received transponder data signal is stored.

4. A universal send/receive utility usage data gathering system having a universal reader/interrogator unit and a transponder unit containing transponder windings with means for communicating with transponder windings; and including means for receiving data indicative of utility usage, storing utility usage data, receiving interrogation signal, and responding with transponder data signal; wherein the transponder and the universal reader/interrogator are capable of passing radiated electromagnetic signals between each other, comprising:

a) an antenna system, adapted to pass electromagnetic signals, having a first set of windings and a second set of windings;
said first set of windings being a part of the universal reader/interrogator unit having a plurality of taps coupled thereto and being electrically selectable as to act as a transmit antenna or as to act as a receive antenna, said taps capable of independent selection;
said second set of windings being the transponder windings and wherein,

b) the universal reader/interrogation unit comprises first means for generating transponder interrogation signal and for storing responsive data signal received from the transponder, said interrogation signal being selected by logic circuits within said reader/interrogation unit to match interrogation requirements of the transponder unit, said first means coupled to second means for selection and impedance matching of said first set of windings to act as a transmit antenna, said second means coupled to said plurality of taps within said first set of windings; and further comprising third means for selection and impedance matching of said first set of windings to act as a receive antenna, said third means

coupled to said plurality of taps within said first set of windings capable of programmed amplification and wave shaping of said received transponder data signal, and in communication with said first means in which said received transponder data signal is stored.

5. A method of operating a universal send/receive utility usage data gathering system comprising a transponder unit and a universal reader/interrogator unit, capable of passing radiated electromagnetic signals between each other; the transponder unit being selected by the operator of the data gathering system, having antenna windings, capable of responding to interrogation signal, and providing transponder data signal; the universal reader/interrogator unit having a selectable multi-tapped antenna and capable of providing interrogation signal, responding to transponder data, internally storing transponder data, responding to software and hardware interrupts, further having means of providing start read signal, means of providing protocol table and associated protocol flag, programmable oscillator means, programmable gain and antenna matching means, necessary communication ports or displays for transferring or reading stored transponder data streams; wherein the protocol table contains a combination of unlicensed and licensed protocols whereby the licensed protocols will provide true protocols and the unlicensed protocols will provide emulated protocols, comprising the interrogator unit steps of:

a) waiting for the start read signal;

b) transmitting an interrogation signal to the selected transponder;

c) waiting for the transponder data response;

d) determining if the transponder data response is valid;

e) if the transponder data response is valid, skipping to step (n);

f) if the transponder data response is invalid, clocking the transponder data response;

g) comparing the clocked transponder data response to the protocol table to determine the type of transponder;

h) setting the protocol flag;

i) setting the programmable oscillator frequency to the chosen interrogation signal;

j) selecting the appropriate windings on the multi-tapped antenna loop;

k) setting the proper system programmable gain;

l) generating required emulation protocol or true protocol, as determined by the protocol flag;

m) skipping to step (b);

n) permanently storing the transponder data stream for later retrieval or display; and

o) returning to step (a).

6. The method of claim **5** wherein the transponder unit is selected from one of the Sensus, Neptune, MasterMeter, or Kent type transponders.

7. The method of claim **5** wherein the transponder antenna winding is a continuous loop.

8. The method of claim **5** wherein the transponder antenna winding is a multi-tapped loop.

9. The method of claim **5** wherein said protocol table may include all true protocol, all emulated protocols and any combination of true and emulated protocols.

* * * * *

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(12) **United States Patent**
Bowman

(10) **Patent No.: US 7,310,052 B2**
(45) **Date of Patent: Dec. 18, 2007**

(54) **WIRELESS METER-READING SYSTEM AND METHODS THEREOF**

(76) Inventor: **Eric L. Bowman**, 270 E. Horizon Dr., Suite 109, Henderson, NV (US) 89105

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 180 days.

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(22) Filed: **Jul. 6, 2005**

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(51) **Int. Cl.**
G08D 23/00 (2006.01)

(52) **U.S. Cl.** **340/870.02**; 340/870.03; 340/870.05; 340/531; 370/401; 382/100

(58) **Field of Classification Search** 340/870.02, 340/870.03, 870.05, 531; 370/401; 382/100
See application file for complete search history.

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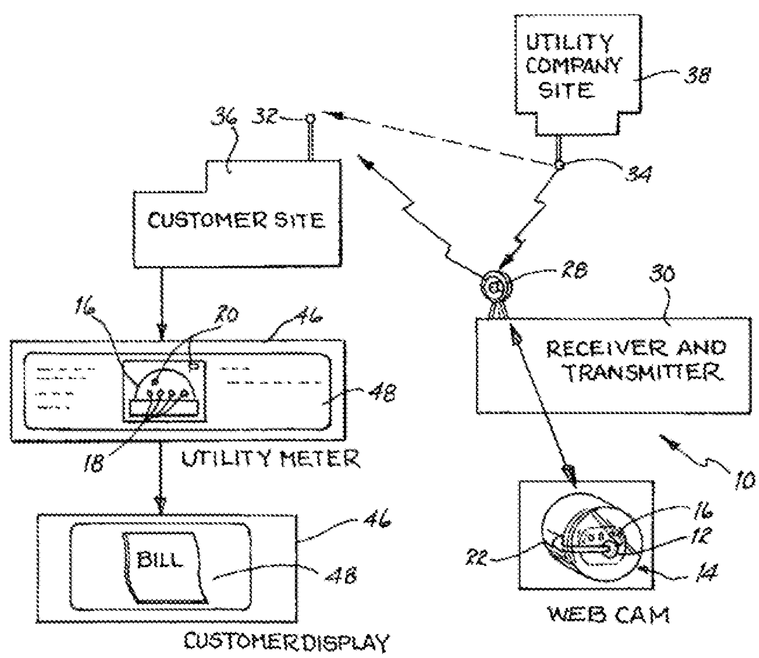
Primary Examiner—Albert K. Wong
(74) *Attorney, Agent, or Firm*—Jeffrey D. Moy; Weiss & Moy, P.C.

(57) **ABSTRACT**

A wireless meter-reading system includes a utility meter having a housing and a face and a recording device located in the housing. The recording device is adapted to read and convert data located on a portion of the face to wirelessly transmittable data. A power source coupled to the recording device permits continuous and instantaneous capture of the wirelessly transmittable data from the face of the utility meter by the recording device. A communication device provided for wirelessly receiving and transmitting data between a consumer site and a utility provider site facilitates monitoring of the face of the utility meter by the consumer site and by the utility provider site. A method for allowing a consumer to join a secured wireless network of a utility provider comprises the consumer paying a fee to the utility provider. Both the consumer and the utility provider benefit from this arrangement.

20 Claims, 5 Drawing Sheets



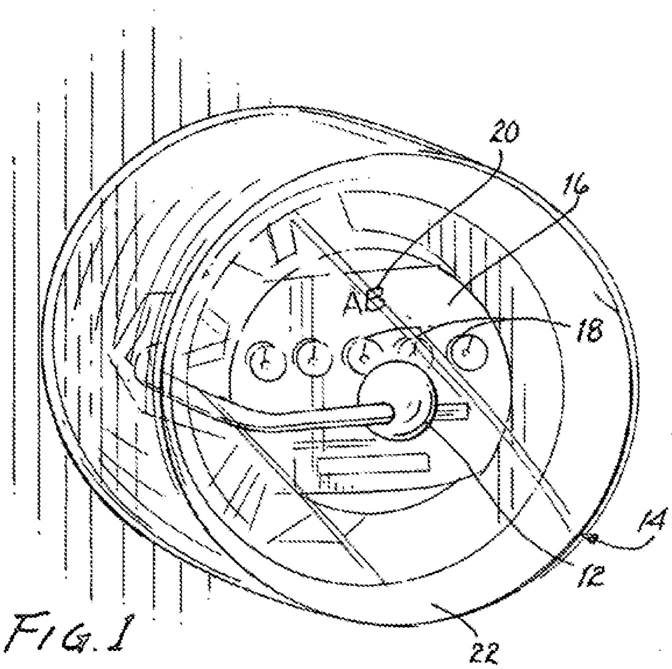


FIG. 1

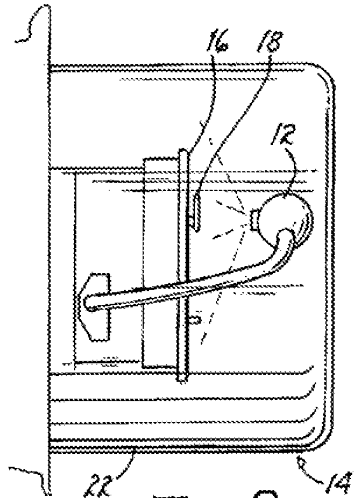


FIG. 2

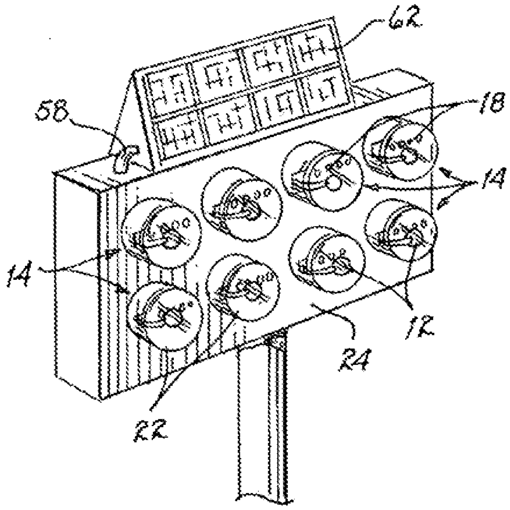


FIG. 3

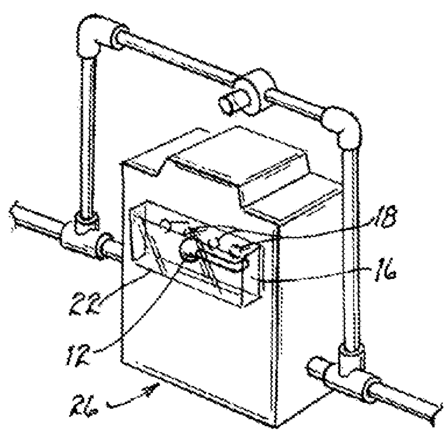


FIG. 4

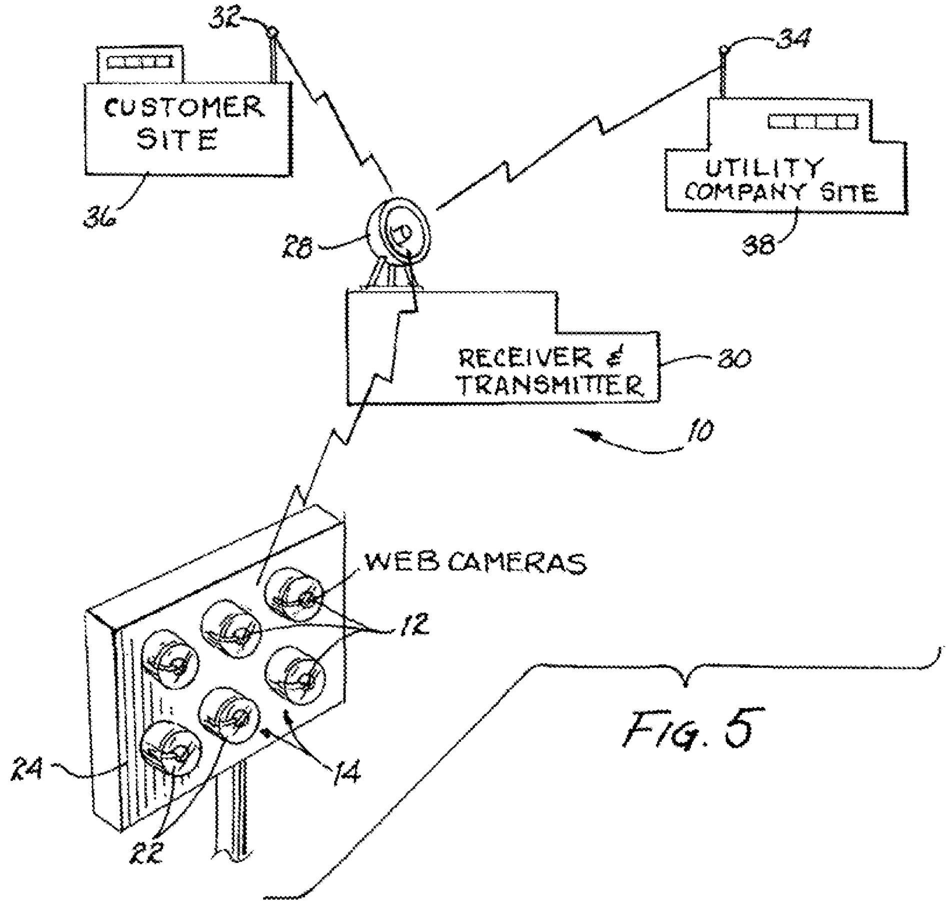
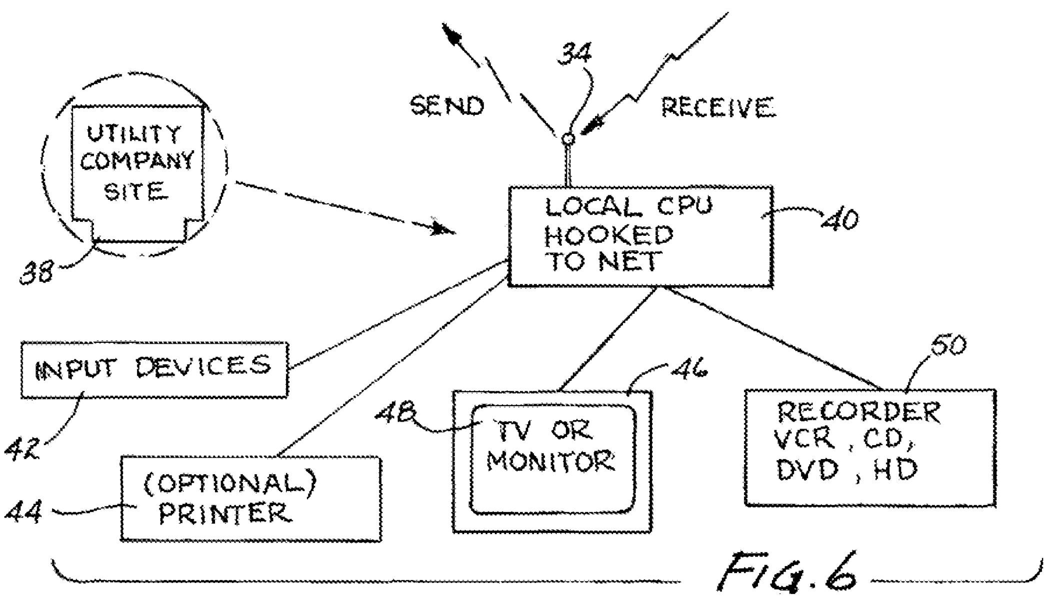

32
34
CUSTOMER SITE
UTILITY COMPANY SITE
36
28
38
RECEIVER & TRANSMITTER
30
10
WEB CAMERAS
12
24
14
22

FIG. 5


SEND
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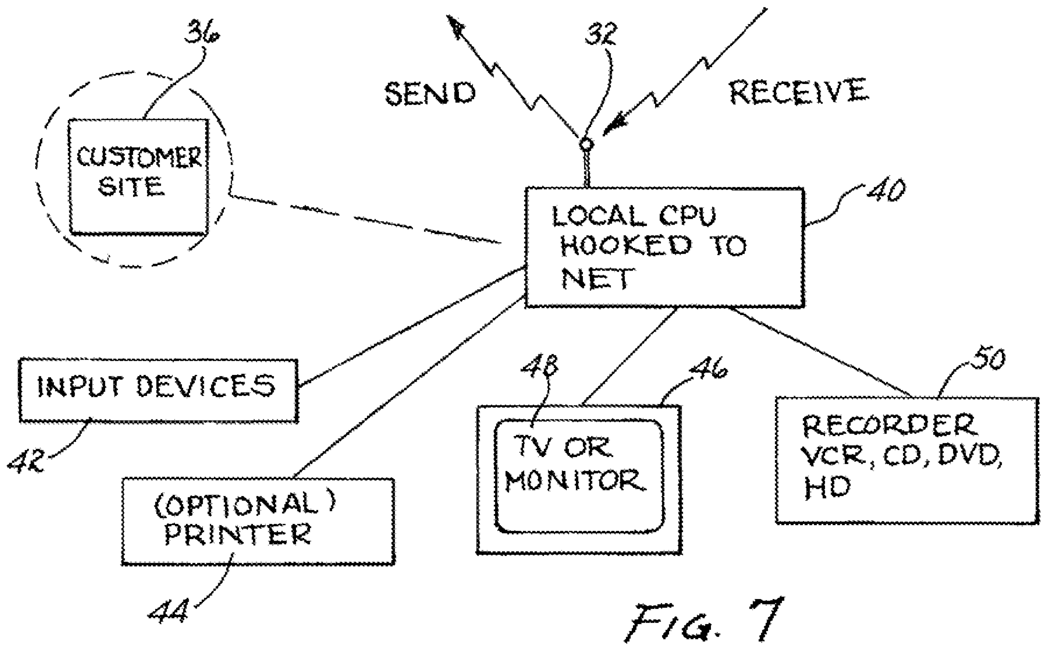
RECEIVE
UTILITY COMPANY SITE
38
LOCAL CPU HOOKED TO NET
40
INPUT DEVICES
42
50
46
48
TV OR MONITOR
RECORDER VCR, CD, DVD, HD
(OPTIONAL) PRINTER
44

FIG. 6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CUSTOMER SITE
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RECEIVE
LOCAL CPU HOOKED TO NET
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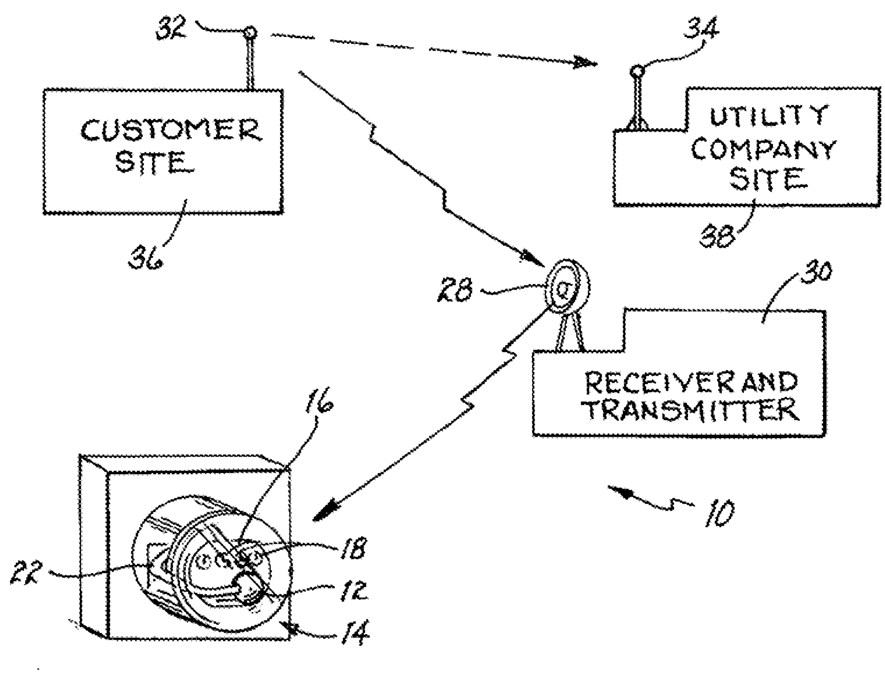
(OPTIONAL) PRINTER
44

FIG. 7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RECEIVER AND TRANSMITTER
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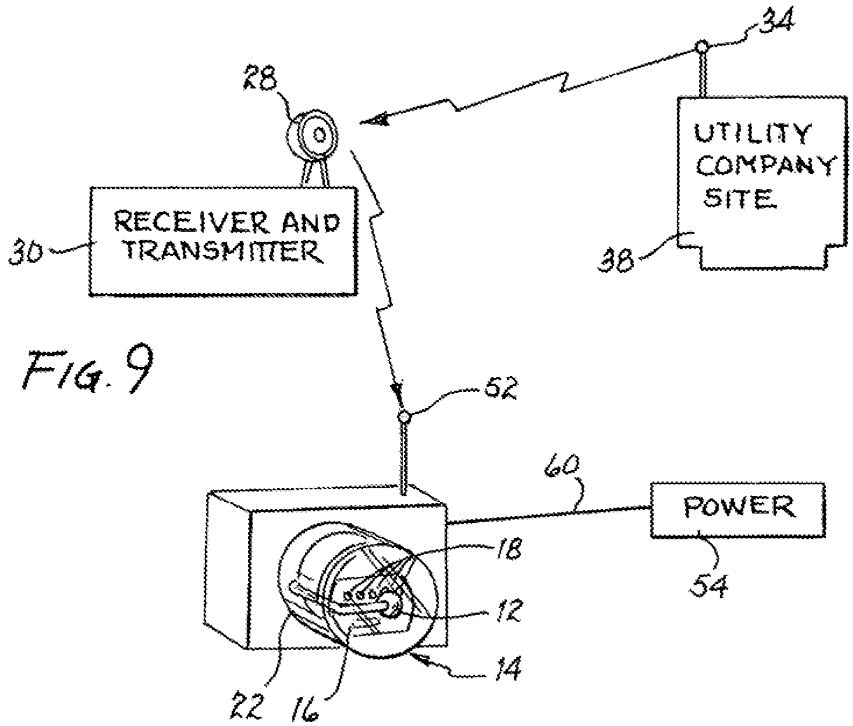
WEB CAMERA

FIG. 8


34
28
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RECEIVER AND TRANSMITTER
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60
POWER
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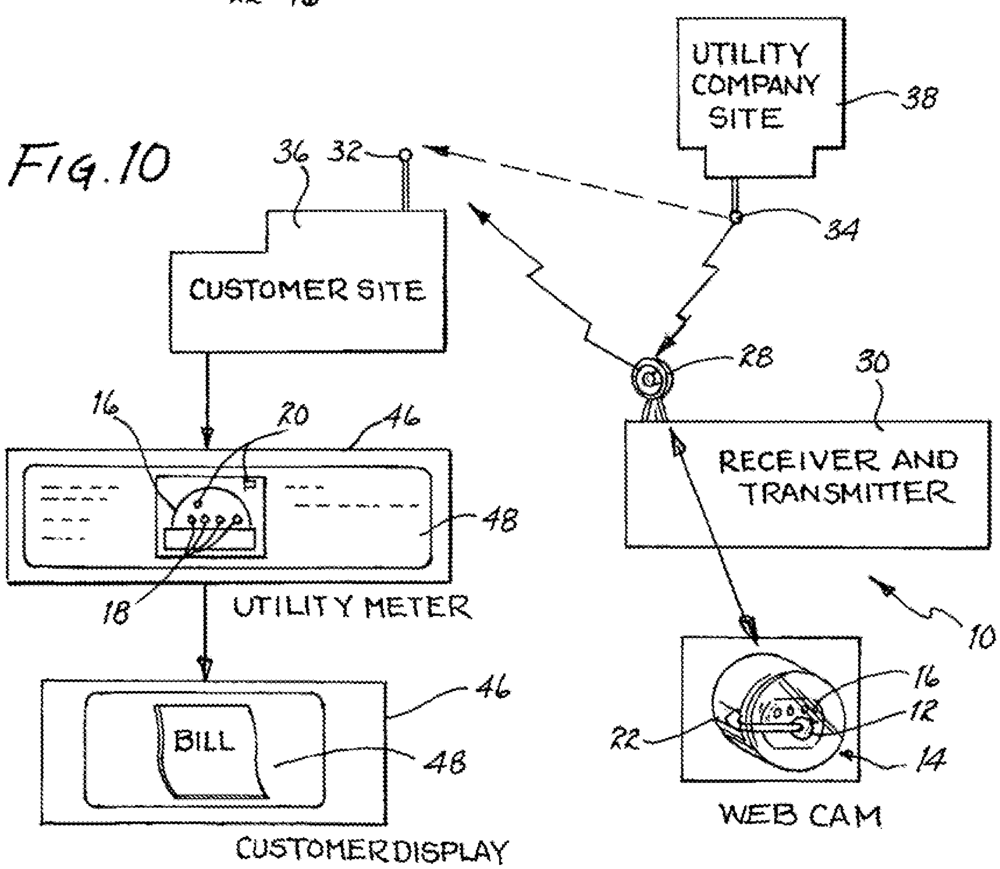
22
16

FIG. 9

FIG. 10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RECEIVER AND TRANSMITTER
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UTILITY METER
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16
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12
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BILL
48
14
WEB CAM
CUSTOMER DISPLAY

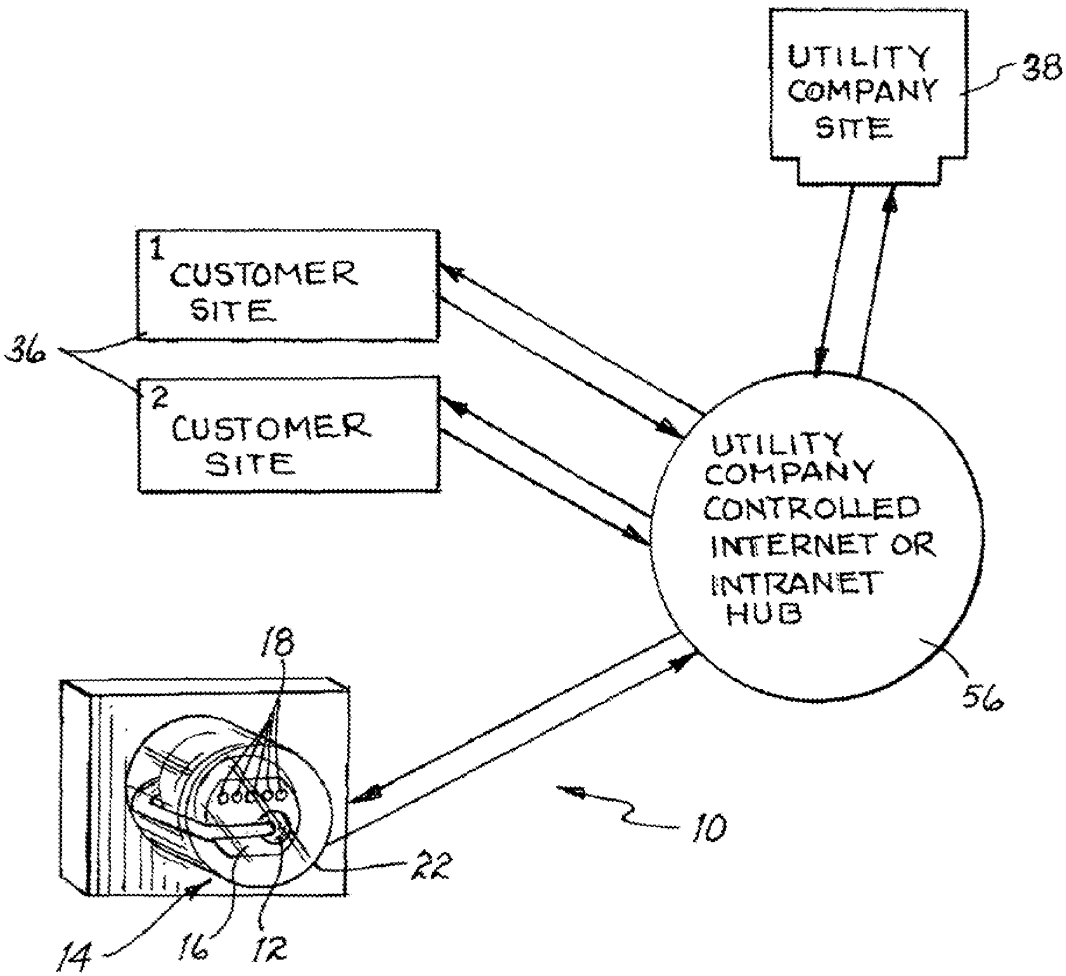
UTILITY COMPANY SITE
38
1 CUSTOMER SITE
2 CUSTOMER SITE
36
UTILITY COMPANY CONTROLLED INTERNET OR INTRANET HUB
56
18
10
22
14
16
12

FIG. 11

WIRELESS METER-READING SYSTEM AND METHODS THEREOF

FIELD OF THE INVENTION

This invention relates generally to meter-reading devices and, more specifically, to an improved wireless meter-reading system, and methods to permit at least one consumer to join a utility provider secured network to display utility usage information instantaneously to the at least one consumer.

BACKGROUND OF THE INVENTION

In the past utility companies depended on employees to inspect the utility meters of their customers visually to determine utility usage. Over 58,000 meter-reading employees work for utility companies and branches of the government in the United States. Meter reading cost the utility provider industry over $1.5 billion every year just in labor alone.

More recently, utility companies have sought out to perform automated meter reading in hopes of improving accuracy and reducing expenses. Recent studies have found that an automated meter reading system could save a utility provider up to $25 per meter every year. This adds up to millions of dollars saved even for companies serving only small metropolitan areas.

Although numerous automated systems have been disclosed, none of these offers both the accuracy and savings fully intended by the disclosers of these automated systems. For example, Myer, U.S. Pat. No. 3,961,316 disclosed a mechanically actuated magnetocrystalline counter enclosed in a utility meter, with the capability of having the magnetically counted utility usage data transmitted remotely. Yoshihara et al., U.S. Pat. No. 4,151,371 disclosed a remote meter reading apparatus comprising interphone means. Gillberry, U.S. Pat. No. 5,870,140 disclosed a system for remote viewing and reporting, wherein a remote camera views a meter and transmits the scanned image to a central computer. These automated systems are all hard-wired systems. More recently, Belski et al., U.S. Pat. No. 6,657,552 disclosed a wireless system for communicating and control of automated meter reading, which depends on a sensor to read utility usage. Several other more recent disclosures also propose various wireless schemes for transmitting utility usage data, but none of these disclosures transmit optical data, such as a visual image of a utility meter. Additionally, these automated systems still require significant manual labor in the recording of meter readings, and are still prone to human error.

Another consideration is that American consumers have previously relied upon their utility providers to provide accurate billing. Following the rate increases that took place in recent years, these same consumers are now questioning the accuracy of their billings. American consumers prefer to be able to see their own meters rather than being told what the meter allegedly used.

For the foregoing reasons, given the limitations of the above-mentioned disclosures, an improved wireless meter-reading system is desirable.

SUMMARY OF THE INVENTION

In its simplest embodiment the wireless meter-reading system is at least one meter having a housing, with an recording device located in the housing of the at least one meter. The recording device is preferably capable of capturing multiple images of a face of the meter having usage data and unique identifying data pertaining to the meter. The recording device (or a module located in the housing of the meter) is adapted to transmit the captured images wirelessly to at least one of a satellite, a cell phone network and a combination router/cable. The captured images are relayed to a secure network hub wirelessly. The captured images are then relayed to both at least one consumer and at least one utility provider, where the visual images of the meter are viewed. According to the disclosure the improved wireless meter-reading system enables all parties with an interest in the utility usage to obtain real-time information. This provides a utility provider with an opportunity to create a new profit center by requesting that a consumer using this wireless automated system to pay a fee to access the automated wireless meter-reading system. The consumer benefits from this arrangement by being able to observe the meter and optimize utility usage. The utility provider benefits by reducing employee costs, knowing when the meter is malfunctioning and optimizing future utility usage needs by observing consumption of the utility, and providing feedback to the consumer about peak usage and how the consumer may be able to reduce utility usage costs.

Accordingly, it is an object of this disclosure to provide an improved wireless meter-reading system.

It is a further object of this disclosure to provide an improved wireless meter-reading system having a wireless meter-reading device located in a housing of a utility meter.

It is yet a further object of this disclosure to provide an improved wireless meter-reading system having a wireless meter-reading device powered by at least one solar-powered energy source.

It is still a further object of this disclosure to provide an improved wireless meter-reading system having a wireless meter-reading device adapted to display utility usage information securely to both at least one utility provider site and at least one consumer site.

It is yet a further object of this disclosure to provide an improved wireless meter-reading system having a wireless meter-reading device adapted to transmit e-mail messages wirelessly between at least one utility provider site and at least one consumer site.

It is a further object of this disclosure to provide a method for transmitting utility meter information wirelessly between at least one consumer site and at least one utility provider site.

It is still a further object of this disclosure to provide a method to permit at least one consumer to join a utility provider secured network, thereby facilitating the display of utility usage information instantaneously to the at least one consumer.

PREFERRED EMBODIMENTS OF THE INVENTION

In accordance with one embodiment of this invention, a wireless meter-reading system is disclosed. The system having at least one consumer site and at least one utility provider site, comprises in combination (a) at least one utility meter having a housing and a face; (b) at least one recording device coupled to the housing, the at least one recording device adapted to read and convert data located on a portion of the face to wirelessly transmittable data; (c) a power source coupled to the recording device for powering the at least one recording device; and (d) a communication device for wirelessly receiving and transmitting data

between the at least one consumer site and the at least one utility provider site to facilitate monitoring of the face of the at least one utility meter by the at least one consumer site and by the at least one utility provider site.

In accordance with a second embodiment of this invention, a method for allowing at least one consumer to join a secured wireless network of at least one utility provider is disclosed. The method comprises the step of (a) providing at least one utility meter having a housing and a face. The method further comprises the step of (b) providing at least one recording device, the at least one recording device in the housing adapted to read and convert data located on a portion of the face to wirelessly transmittable data. The method further comprises the step of (c) providing a power source coupled to the at least one recording device. The method further comprises the step of (d) providing a communication device provided for wirelessly receiving and transmitting data between the at least one consumer and the at least one utility provider, thereby facilitating monitoring of the face of the at least one utility meter by the at least one consumer and by the at least one utility provider. The method further comprises the step of (e) providing a secured network hub by the at least one utility provider to relay data from the at least one utility provider to the at least one consumer. The method further comprises the step of paying a fee by the at least one consumer to the at least one utility provider allowing the at least one consumer to join the secured wireless network of the at least one utility provider, and thereby instantaneously receive at least utility usage data and current billing data of the at least one consumer from the secured wireless network comprising a combination of the at least one recording device located in the at least one utility meter, the power source coupled to the at least one recording device, the communication device, and a network hub secured by the at least one utility provider.

In accordance with a third embodiment of this invention, a wireless meter-reading system is disclosed. The system having at least one consumer site and at least one utility provider site, comprises in combination (a) at least one utility meter having a housing and a face; (b) at least one recording device coupled to the housing, the at least one recording device adapted to read and convert data located on a portion of the face to wirelessly transmittable data; (c) a power source coupled to the recording device for powering the at least one recording device; and (d) a communication device for wirelessly receiving and transmitting data between the at least one consumer site and the at least one utility provider site to facilitate instantaneous and continuous monitoring of the face of the at least one utility meter by the at least one consumer site and by the at least one utility provider site.

The foregoing and other articles, features, and advantages of the invention will be apparent from the following more detailed description of the preferred embodiments of the invention, as illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a portion of a wireless meter-reading system according to the present invention.

FIG. **2** is a perspective view of a portion of the wireless-meter reading system of FIG. **1** showing a side view of the recording device.

FIG. **3** is a perspective view of a second embodiment of the wireless meter-reading system.

FIG. **4** is a perspective view of a portion of a third embodiment of the wireless meter-reading system.

FIG. **5** is a schematic diagram of a portion of the second embodiment of the wireless meter-reading system of FIG. **3**.

FIG. **6** is a schematic diagram showing a feature of a portion of a wireless meter-reading system of a utility company site.

FIG. **7** is a schematic diagram showing a second feature of a portion of a wireless meter-reading system of a customer site.

FIG. **8** is a schematic diagram of a fourth embodiment of a portion of the wireless meter-reading system

FIG. **9** is a schematic diagram of a portion of a fifth embodiment of the wireless meter-reading system.

FIG. **10** is a schematic diagram of another feature of a portion of the fourth embodiment of the wireless meter-reading system of FIG. **8** showing a screen display of a customer monitor, as well as showing an alternative screen display of the customer monitor.

FIG. **11** is a schematic diagram of a portion of a sixth embodiment of the wireless meter-reading system showing at least one of an intranet utility company hub and an internet utility company hub with each one of at least one customer site coupled wirelessly to the utility company site through the at least one of the internet utility company hub and the intranet utility company hub.

DESCRIPTION OF THE INVENTION

In this application, the term "consumer site" is interchangeable with the term "customer site", and the term "utility company site" is interchangeable with the term "utility provider site". Furthermore, in this application, the terms "customer" and "consumer" are interchangeable, as are the terms "utility company" and "utility provider". The term "network hub" is interchangeable with either one of the terms "internet network" and "intranet network".

According to FIG. **1**, a portion of a wireless meter-reading system **10** comprises at least one utility meter **14** (shown in FIG. **1** as an electric utility meter **14**) having a housing **22** and including a face **16**. The housing **22** preferably comprises a substantially transparent durable polymer. The face **16** of the at least one utility meter **14** comprises at least utility usage data **18** (shown in FIG. **1** as a plurality of numeric dials **18**) of the at least one utility meter **14**. The movement of each one of the plurality of dials **18** indicates (counts) utility usage. The face **16** of the utility meter **14** displays identifying data **20**. The identifying data **10** uniquely identifies each utility meter **14** that corresponds to each customer (or consumer) site **36** (see FIGS. **5**, **7**, **8**, **10** and **11**). A portion of the wireless meter-reading system **10** further comprises at least one recording device **12**.

The recording device **12** is adapted to read and convert the data (the utility usage data **18** and the identifying data **20**) located on a portion of the face **16** to wirelessly transmittable data. Conversion methods include various compression schemes for transmitting digital data more easily, including Joint Photographic Experts Group ("jpeg") formats and the like. The recording device **12** is located in the housing **22** of the utility meter **14**. The recording device **12** may be at least one of a digital camera, a web camera, an electronic eye, a laser, a digitally counting electronic chip, a scanner, a bar code reader or the like. The listing of the above is not to be construed as a limitation of the scope of the present disclosure. Preferably, the recording device **12** comprises a charge-coupled device (CCD) sensor having at least about 0.03 mega-pixel resolution and the recording device **12** captures visual images through a small fixed lens. The recording device **12** converts the visual images to electric pulses and

either temporarily saves these electric pulse images in on-board memory within the at least one recording device **12** for subsequent wireless transmission, or immediately transmits these electric pulse images wirelessly. Preferably, each one of the electric pulse images has at least a resolution of 160×120 pixels. The recording device **12** may be a still digital camera or a digital camera capable of continuous operation such as a digital movie camera operating at a speed of at least 15 frames per second. An aperture of the lens of the recording device **12** has both auto-focus and auto light settings, thereby taking into account prevailing environmental conditions. If the recording device **12** is a digital camera, a digital shutter of the recording device **12** controls the operation of the recording device **12**.

A portion of the wireless meter-reading system **10** may further comprise the utility meter **14** having an alarm (shown as a portion of the recording device **12** coupled to the housing **22**) adapted to alert the utility provider (or utility company) site **38** (see FIGS. **5**, **6**, **8**, **9**, **10** and **11**) when the utility meter **14** is inoperable and requires repair. A portion of the wireless meter-reading system **10** may further comprise a light source (not shown) located in the housing **22** of the utility meter **12**. The light source may be activated under low light conditions where the auto light setting may be inadequate, thereby facilitating optical capture of wirelessly transmittable data (utility usage data **18** and identifying data **20** converted into electronic form) from the face **16** of the utility meter **12**.

The housing **22** of the utility meter **14** may further have at least one wireless transfer module located in the housing **22**. Alternatively, the recording device **12** may comprise the wireless transfer module (not shown). Well-known wireless technologies having wireless transfer modules include UWB, 802.11g, 802.11a, 802.11b, WLAN, Wi-Fi®, AirPort, Infrared, Bluetooth ® and ZIGBEE™, and the like. However, wireless technology is a rapidly developing technical field and the above listing of wireless technologies should not be construed as a limitation of the current disclosure. With the wireless transfer module (described above), e-mail may be sent wirelessly to a secure (intranet or internet) network hub **56** (not shown in FIG. **1**, but shown in FIG. **11**, described below) by a communication device **30** provided for wirelessly receiving and transmitting data (see FIGS. **5**, **8**, **9** and **10**, described below). The secure network hub **56** is controlled by the at least one utility company (or provider) site **38**, and e-mail may be distributed to both the customer (or consumer) site **36** and the utility company (or utility provider) site **38**. The secured network hub **56** comprises a server (not shown) of a central processing unit (not shown in FIG. **1**) preferably controlled by the utility provider site **38**. The server of the secured network hub **56** wirelessly relays data to at least one local CPU **40** having an antenna **34** located at the at least one utility company site **38** (see FIG. **6**). The server of the secured network hub **56** also wirelessly relays data to at least one local central processing unit (CPU) **40** having an antenna **32** located at the at least one customer site **36** (see FIG. **7**).

The communication device **30** comprises a combination of a router/modem (depicted as a portion of a block diagram). An antenna **28** of the communication device **30** for wirelessly receiving and transmitting, see FIGS. **5**, **8**, **9** and **10**) couples the combination of the router/modem wirelessly to both the recording device **12** and to the secured network hub **56**. The secured network hub **56** relays visual images of the face **16** of the utility meter **14** from the recording device **12** to the customer (or consumer site) **36** and to the one utility company (or utility provider) site **38**. The secured network hub **56** facilitates e-mail transmissions between the utility company (or utility provider) site **38** and the customer (or consumer site) **36**. Alternatively, the communication device **30** may be at least one of a satellite (depicted as a portion of a block diagram denoted "receiver and transmitter") and a cell phone network (depicted as a portion of a block diagram denoted "receiver and transmitter"), and the like. The communication device **30** is wirelessly coupled to the recording device **12** (such as a wireless cell phone). It is understood that when the communication device **30** is coupled to a wireless cell phone, the wireless cell phone further comprises at least a recording device **12** such as a digital camera, and the like. The wireless cell phone may be programmed to respond to transmissions from both the customer site **36** and the utility company site **38**. Each one of the satellite and the cell phone network is adapted to relay data from the recording device **12** located in the housing **22** of the utility meter **14** to the consumer site **36** and to the utility provider site **38**.

Referring to FIG. **2**, a side view of a portion of the wireless meter-reading system **10** includes the recording device **12** positioned in the housing **22** of the electric utility meter **14** of FIG. **1**. The recording device **12** is adapted to read the face **16**, having the utility usage data **18** and the identifying data **20** (not shown in FIG. **2**), located thereon of the electric utility meter **14**.

Referring now to FIG. **3**, a second embodiment of the wireless meter-reading system **10** shows a plurality of electric utility meters **14** located on a panel **24**. The second embodiment of the wireless meter-reading device **10** is particularly applicable in an apartment or a condominium complex, but may also be useful in a housing complex where it is highly desirable to optimize energy usage. A power source is provided for powering the at least one recording device **12**. In FIG. **3** the power source comprises a solar panel **62**. The solar panel **62** is coupled to the panel **24**. A cable **58** having a multiplicity of lines couples the solar panel **62** to the recording device **12** (depicted in FIG. **1**), located in a housing **22** of each electric utility meter **14** of the plurality of electric utility meters **14**. The second embodiment of FIG. **3** herein is particularly suitable in climates where there are many days of sunshine. It is understood without limitation that the power source may comprise at least one of a battery, a solar power panel, a wind turbine, a portion of power supplied to the utility meter **14**, and the like.

Referring to FIG. **4**, a portion of a third embodiment of the wireless meter-reading system shows a front side of a gas utility meter **26**. The gas utility meter **26** has a face **16** located on the gas utility meter **26**, with at least one recording device **12** (similar to the recording device **12** of FIG. **1**) located in a housing **22** of the gas utility meter **26**. It is understood that without limitation the utility meter **12** may comprise at least one of an electric meter, a gas meter, a water meter, and the like.

Referring now to FIG. **5**, a schematic diagram of a portion of the second embodiment of the wireless meter-reading system **10** of FIG. **3** (without the at least one solar panel **62**) shows the plurality of electric utility meters **14**. Each one of the plurality of electric utility meters **14** has the at least one recording device **12** (depicted in FIG. **1**) denoted as a "web camera" **12** located in the housing **22** of each one of the electric utility meters **14**. The at least one recording device **12** of each of the plurality of utility meters **14** is adapted to communicate wirelessly with the remote antenna **28** of the communication device **30** (shown as a block diagram denoted "receiver and transmitter" **30**). The communication

device 30 facilitates wireless relay of information between the remote antenna 28 and each of an antenna 32 of the customer (or consumer) site 36 and an antenna 34 of the utility company (or utility provider) site 38 (each shown as a block diagram).

According to FIG. 6, a schematic diagram shows a feature of a portion of the wireless meter-reading system 10 of the utility company (utility provider) site 38. The utility company site 38 comprises at least one local central processing unit (CPU) 40 coupled to the server (not shown in FIG. 11, described below) of the secured network hub 56 (not shown in FIG. 6, but shown in FIG. 11, described below). The local CPU 40 of the utility company site 38 has at least one input device 42 and at least one output device including a printer 44, a monitor (or TV) 46 and a recorder device 50 (denoted "recorder" 50). The input device 42 comprises at least one of a mouse, a keyboard and an electronic writing pad, and the like. The input device 42 permits a user of the utility company site 38 to input data to be transmitted via the communication device 30 to the customer site 36. The input device 42 also permits the user of the utility company site 38 to input data wirelessly to the recording device 12 located in the housing 22 of the utility meter 14 of the customer site 36. The recorder device 50 is selected from the group consisting of a videocassette recorder, a compact disk recorder, a digital videodisk recorder, a floppy disk and a hard disk, and the like. The local CPU 40 both sends and receives data wirelessly from the antenna 34 of the local CPU 40 to the remote antenna 28 (not shown in FIG. 6) of the communication device 30.

Referring to FIG. 7, a schematic diagram shows a second feature of a portion of the wireless meter-reading system 10 of the customer (consumer) site 36. The customer site 36 comprises at least one local central processing unit (CPU) 40 of the customer site 36 coupled to the server (not shown in FIG. 11, described below) of the secured network hub 56 (not shown in FIG. 7, but shown in FIG. 11, described below). The one local CPU 40 of the customer site 36 has at least one input device 42 and at least one output device including a printer 44, a monitor (or TV) 46 and a recorder device 50 (denoted recorder 50). The input device 42 comprises at least one of a mouse, a keyboard and an electronic writing pad, and the like. The input device 42 permits a user of the customer site 36 to input data to be transmitted via the communication device 30 to the utility company site 38. The input device 42 permits the user of the customer site 36 to input data to be transmitted wirelessly to the recording device 12 located in the housing 22 of the utility meter 14 of the customer site 36. The recorder device 50 is selected from the group consisting of a videocassette recorder, a compact disk recorder, a digital videodisk recorder, a floppy disk and a hard disk, and the like. The local CPU 40 of the customer site 36 both sends and receives data wirelessly from the antenna 32 of the local CPU 40 of the customer site 36 to the remote antenna 28 (not shown in FIG. 7) of the communication device 30.

Referring now to FIG. 8, a schematic diagram of a fourth embodiment of a portion of the wireless meter-reading system 10 shows one utility meter 12 having the recording device 12 (denoted as a "web camera" 12). The recording device 12 is adapted to wirelessly relay data (as described above) to the antenna 28 of the communication device 30 (shown as a block diagram "receiver and transmitter" 30). The communication device 30 facilitates data transmission between both of the antenna 32 of the customer site 36 (shown as a block diagram) and the antenna 34 of the utility company site 38 (shown as a block diagram). It is understood that wireless transmission may occur between the antenna 32 of the customer site 36 and the antenna 34 of the utility company site 38 through the secured network hub 56 (not shown in FIG. 8, but shown in FIG. 11, described below).

Referring to FIG. 9, a schematic diagram of a portion of a fifth embodiment of the wireless meter-reading system 10 shows the utility meter 14 (shown as the electric utility meter 14) of the customer site 36. The utility meter 14 has the recording device 12 located in the housing 22 of the at least one utility meter 14. A line 60 couples the recording device 12 to a power supply 54 (shown as a block diagram denoted "power" 54). The power supply 54 is adapted to provide continuous power to the recording device 12. A portion of the housing 22 of the utility meter 14 comprises an antenna 52 for wirelessly relaying data to the antenna 28 of the communication device 30 (shown as a block diagram denoted "receiver and transmitter" 30). Alternatively, the antenna 52 may be a portion of the wireless transfer module located in a portion of the housing 22 of the electric utility meter 14 or a portion of the at least one recorder 12. The antenna 28 of the communication device 30, relays data both to and from the utility company site 38.

Turning now to FIG. 10, a schematic diagram of another feature of a portion of the fourth embodiment of the wireless meter-reading system 10 (see FIG. 8 also) shows the utility meter 14 (shown in FIG. 10 as an electric utility meter 14) has the recording device 12 denoted "web camera". A remote antenna 28 of the communication device 30 (shown as a block diagram denoted "receiver and transmitter") couples wirelessly to the antenna 32 of the customer site 36 and to the antenna 34 of the utility company site 38 (each shown as a block diagram). Furthermore, a portion of a screen 48 of the monitor 46 of the customer site 36 includes at least one image of a portion of the face 16 of the utility meter 14 located at the customer site 36. Additionally, other information transmitted to the customer site 36 by the utility company site 38 may be shown on a portion of the screen 48 together with the at least one image of the face 16 of the utility meter 14. For example, other information may include at least one of a log on user name and password request, a log off request, a message from the utility company 38 indicating better strategies for decreasing utility usage costs, and the utility usage data (currently shown as the plurality of dials 18, see description above) shown as numeric data, and the like. An alternative portion of the screen 48 of the monitor 46 of the customer site 36 may include a billing statement transmitted to the customer site 36 from the utility company site 38. It is understood that a portion of a screen 48 of the monitor 46 of the utility company site 38 may also comprise an image of the face 16 of the utility meter 14 of the customer site 36, together with other information (not shown in FIG. 10). It is further understood that the utility company site 38 may be wirelessly coupled directly to the customer site 36, preferably through the secured network hub 56 (not shown in FIG. 10, but shown in FIG. 11, described below).

Referring to FIG. 11, a schematic diagram of a portion of a sixth embodiment of the wireless meter-reading system 10 shows the utility meter 14 (FIG. 11 shows the electric utility meter 14) having recording device 12 located in the housing 22 of the utility meter 14. The recording device 12 is coupled to the secured network hub 56 (at least one of an internet utility company hub and an intranet utility company hub in a block diagram denoted as "utility company controlled internet or intranet hub"). Each one of at least one customer site 36 (denoted as "1 customer site, 2 customer site" in

block diagrams) is coupled wirelessly to the utility company site **38** through the secured network hub **56**. The secured network hub **56** may comprise a server of a central processing unit programmed to wirelessly relay data from the utility meter **14** to both the one customer site **36** and the utility company site **38**. Additionally, the server may be programmed to wirelessly relay data from the customer site **36** to the utility company site **38** directly. Additionally, the server may be programmed to wirelessly relay data from the utility company site **38** directly to the at least one customer site **36**. It is understood that the secured network hub **56** may relay data through communication device **30** (not shown in FIG. **11**, but described above and shown in FIGS. **5**, **8**, **9** and **10**). A user of the customer site **36** may join the secured network hub **56** of the utility company site **38** by paying a set-up fee. The at least one utility company site **38** may also request maintenance fees from the user of the customer site **36** to continue usage of the secured network hub **56**. The fees described above may be an extra income stream for the utility company site **38**, while providing enhanced services for the customer site **36**.

Exemplary Method for Allowing at Least One Consumer to Join a Secured Wireless Network of at Least One Utility Provider

Details of the individual components making up the secured wireless network are the same as described above.

A method for allowing at least one consumer to join a secured wireless network of at least one utility provider, comprises a number of steps. The method comprises the step of the utility provider providing a utility meter **14** having a housing **22** and the utility meter **14** including a face **16**. The method further comprises the step of the utility provider providing at least one recording device **12**. The recording device **12** is adapted to read and convert data located on a portion of the face **16** of the utility meter **14** to wirelessly transmittable data, and the recording device **12** is located in the housing **22** of the utility meter **14**. Subsequently, the method comprises the step of providing a power source for powering the recording device **12**, thereby permitting continuous and instantaneous capture of the wirelessly transmittable data from the face **16** of the utility meter **14** by the recording device **12**. The method further comprises the steps of providing a communication device **30** provided for wirelessly receiving and transmitting data between the consumer and the utility provider, thereby facilitating instantaneous and continuous monitoring of the face **16** of the utility meter **14** by the consumer and by the utility provider. The method further comprises the step of the utility provider providing a secured network hub **56** adapted to relay data from the utility provider to the consumer. The method further comprises the step of the consumer paying a fee to the utility provider allowing the consumer to join the secured wireless network **56** of the utility provider, and thereby instantaneously receive at least utility usage data and current billing data of the consumer from the secured wireless network.

The method further comprises the step of displaying the utility usage data **18** and the identifying data **20** of the utility meter **14** on the screen **48** of the monitor **46** of the consumer and on the screen **48** of the monitor **46** of the utility provider. Furthermore, the method comprises the steps of the consumer determining excessive utility usage by monitoring the face **16** of the utility meter **14** of the consumer over the secure network hub **56**. By implementing the previous steps, the consumer is enabled to reduce wasteful utility usage by the consumer, thereby conserving utility usage and reducing costs of the consumer.

The method further comprises the steps of the utility provider monitoring the face **16** of the utility meter **14** of each one of at least one consumer over the secure network hub **56** and the utility provider predicting future utility usage of each consumer. By implementing the previous steps, the utility provider is enabled to improve planning for utility expansion. The utility provider is further enabled to improve planning of peak usage times of the utility usage of each consumer to allocate costs of the utility usage to each consumer during peak usage times efficiently.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention. For example, instead of the recording device being housed in the utility meter, in an alternative embodiment, the recording device may be located out of the utility meter. An example of a recording device suitable for such use is a JCAM IP WEB CAMERA™ manufactured by J-Systems, Inc., IL, USA, which is a harsh environment solar powered wireless IP (Web) camera system. The JCAM IP WEB CAMERA™ is a remote security device, but may be adapted to be used as the recording device contemplated by this disclosure because the JCAM IP WEB CAMERA™ has sufficient resolution capability. Additionally, secure network hub capabilities may be contracted from an internet service provider (ISP) by the utility provider (utility company). Besides being an electric utility meter, a gas utility meter or a water utility meter, the utility meter may be any other meter used to gauge usage of a commodity.

What is claimed is:

1. A wireless meter-reading system having at least one consumer site and at least one utility provider site, comprising, in combination:

(a) at least one utility meter having a housing and a face;

(b) at least one recording device coupled to said housing, said at least one recording device adapted to read and convert data located on a portion of said face to wirelessly transmittable data, said at least one recoding device capturing visual images of the data located on a portion of said face;

(c) a power source coupled to the recording device for powering said at least one recording device; and

(d) a communication device for wirelessly receiving and transmitting data between said at least one consumer site and said at least one utility provider site to facilitate monitoring of said face of said at least one utility meter by said at least one consumer site and by said at least one utility provider site, said communication device relaying the visual images of said face of said at least one utility meter from said at least one recording device to said at least one consumer site, and said secured network hub facilitating e-mail transmission between said at least one utility provider site and said at least one consumer site, wherein said email transmission including a billing statement and visual images confirming said billing statement.

2. The system of claim **1** further comprising an alarm coupled to said at least one utility meter adapted to alert said at least one utility provider site when said at least one utility meter is inoperable and requires repair.

3. The system of claim **1** further comprising a light source located in said housing of said at least one utility meter, to

enhance optical capture of said wirelessly transmittable data from said face of said at least one utility meter.

4. The system of claim 1, wherein said at least one utility meter comprises at least one of an electric meter, a gas meter, and a water meter.

5. The system of claim 1, wherein said at least one recording device comprises at least one digital camera, a web camera, an electronic eye, a laser, a digitally counting electronic chip, a scanner and a bar code reader.

6. The system of claim 1, wherein said face of said at least one utility meter comprises utility usage data and identifying data of said at least one utility meter from said at least one consumer site.

7. The system of claim 1, wherein said power source comprises at least one of a battery, a solar power panel, a wind turbine and a portion of power supplied to said at least one utility meter.

8. The system of claim 1, wherein said communication device is coupled wirelessly to both said at least one at least one recording device and to a secured network hub.

9. The system of claim 8, wherein said secured network hub comprises a server of a central processing unit of said at least one utility provider site.

10. The system of claim 1, wherein both said at least one consumer site and said at least one utility site have at least one input device and at least one output device.

11. A method for allowing at least once consumer to join a secured wireless network of at least one utility provider, comprising the steps of:

(a) providing at least one utility meter having a housing and a face;

(b) providing at least one recording device, said at least one recording device in said housing adapted to read and convert data located on a portion of said face to wirelessly transmittable data, said at least one recoding device capturing visual images of the data located on a portion of said face;

(c) providing a power source coupled to said at least one recording device;

(d) providing a communication device provided for wirelessly receiving and transmitting data between said at least one consumer and said at least one utility provider, thereby facilitating monitoring of said face of said at least one utility meter by said at least one consumer and by said at least one utility provider, said communication device relaying the visual images of said face of said at least one utility meter from said at least one recording device to said at least one consumer site, and said secured network hub facilitating data transmission between said at least one utility provider site and said at least one consumer site, wherein said data transmission including a billing statement and visual images confirming said billing statement; and

(e) providing a secured network hub by said at least one utility provider to relay data from said at least one utility provider to said at least one consumer.

12. The method according to claim 11 further comprising the step of:

paying a fee by said at least one consumer to said at least one utility provider allowing said at least one consumer to join said secured wireless network of said at least one utility provider, and thereby instantaneously receive at least utility usage data and current billing data of said at least one consumer from said secured wireless network comprising a combination of said at least one recording device located in said at least one utility meter, said power source coupled to said at least one recording device, said communication device, and a network hub secured by said at least one utility provider.

13. The method according to claim 11 further comprising the steps of:

providing said at least one utility meter having an alarm to alert said at least one utility provider when said at least one utility meter is inoperable and requires repair by said at least one utility provider; and

providing a light source located in said housing of said at least one utility meter, said light source activated under low light conditions to facilitate optical capture of data from said face of said at least one utility meter.

14. The method according to claim 11 further comprising the steps of:

providing said at least one utility meter comprising at least one of an electric meter, a gas meter, and a water meter; and

providing said at least one recording device comprising at least one recording device comprising at least one of a digital camera, a wed camera, an electronic eye, a laser, a digitally counting electronic chip, a scanner, and a bar code reader.

15. The method according to claim 11 further comprising the step of:

providing said secured network hub comprises a server of a central processing unit of said at least one utility provider.

16. The method according to claim 11 further comprising the step of:

providing both said at least one consumer and said at least one utility provider have at least one input device and at least one output device.

17. The method according to claim 11 further comprising the steps of:

providing a portion of said face of said at least one utility meter comprising at least utility usage data and identifying data of said at least one utility meter of said at least one consumer; and

displaying said utility usage data and said identifying data of said at least one utility meter on a screen of a monitor of said at least one consumer and on a screen of a monitor of said at least one utility provider.

18. The method according to claim 11, further comprising the step of:

determining excessive utility usage by said at least one consumer by monitoring said face of said at least one utility meter of said at least one consumer over said secure network hub to reduce wasteful utility usage by said at least one consumer, conserve utility usage and reduce costs of said at least one consumer.

19. The method according to claim 11, further comprising the steps of:

monitoring said face of said at least one utility meter of each of said at least one consumer over said secure network hub by said at least one utility provider;

predicting future utility usage of each of said at least one consumer by said at least one utility provider to improve planning for utility expansion and planning to allocate costs of peak usage times of said utility usage of each of said at least one consumer efficiently.

20. A wireless meter-reading system having at least one consumer site and at least one utility provider site, comprising, in combination:

(a) at least one utility meter having a housing and a face;

(b) at least one recording device coupled to said housing, said at least one recording device adapted to read and

convert data located on a portion of said face to wirelessly transmittable data, said at least one recoding device capturing visual images of the data located on a portion of said face;

(c) a power source coupled to the recording device for powering said at least one recording device; and

(d) a communication device for wirelessly receiving and transmitting data between said at least one consumer site and said at least one utility provider site to facilitate instantaneous and continuous monitoring of said face of said at least one utility meter by said at least one consumer site and by said at least one utility provider site, said communication device relaying the visual images of said face of said at least one utility meter from said at least one recording device to said at least one consumer site, and said secured network hub facilitating data transmission between said at least one utility provider site and said at least one consumer site, wherein said data transmission including a billing statement and visual images confirming said billing statement.

* * * * *

US008644804B2

(12) United States Patent
Blackwell et al.

(10) Patent No.: US 8,644,804 B2
(45) Date of Patent: Feb. 4, 2014

(54) **METHOD AND SYSTEM FOR PROVIDING WEB-ENABLED CELLULAR ACCESS TO METER READING DATA**

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(73) Assignee: **Badger Meter, Inc.**, Milwaukee, WI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 241 days.

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(22) Filed: **Oct. 2, 2009**

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H04M 3/42 (2006.01)

(52) **U.S. Cl.**
USPC **455/414.1**

(58) **Field of Classification Search**
USPC 340/870.02, 870.03; 455/414.1
See application file for complete search history.

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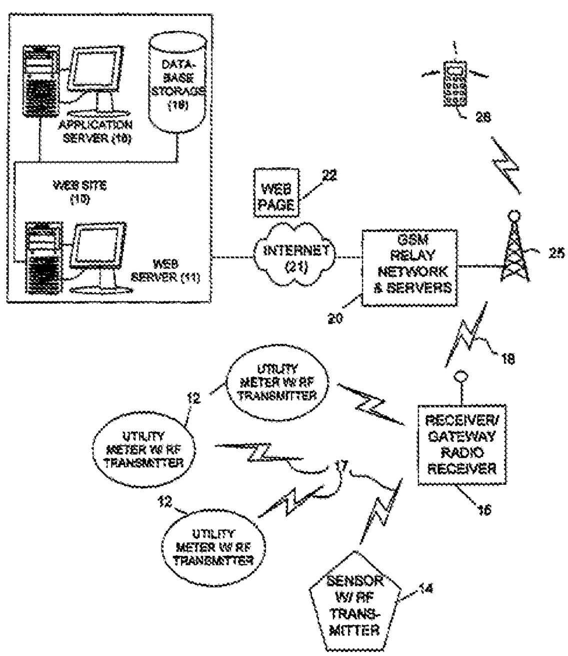
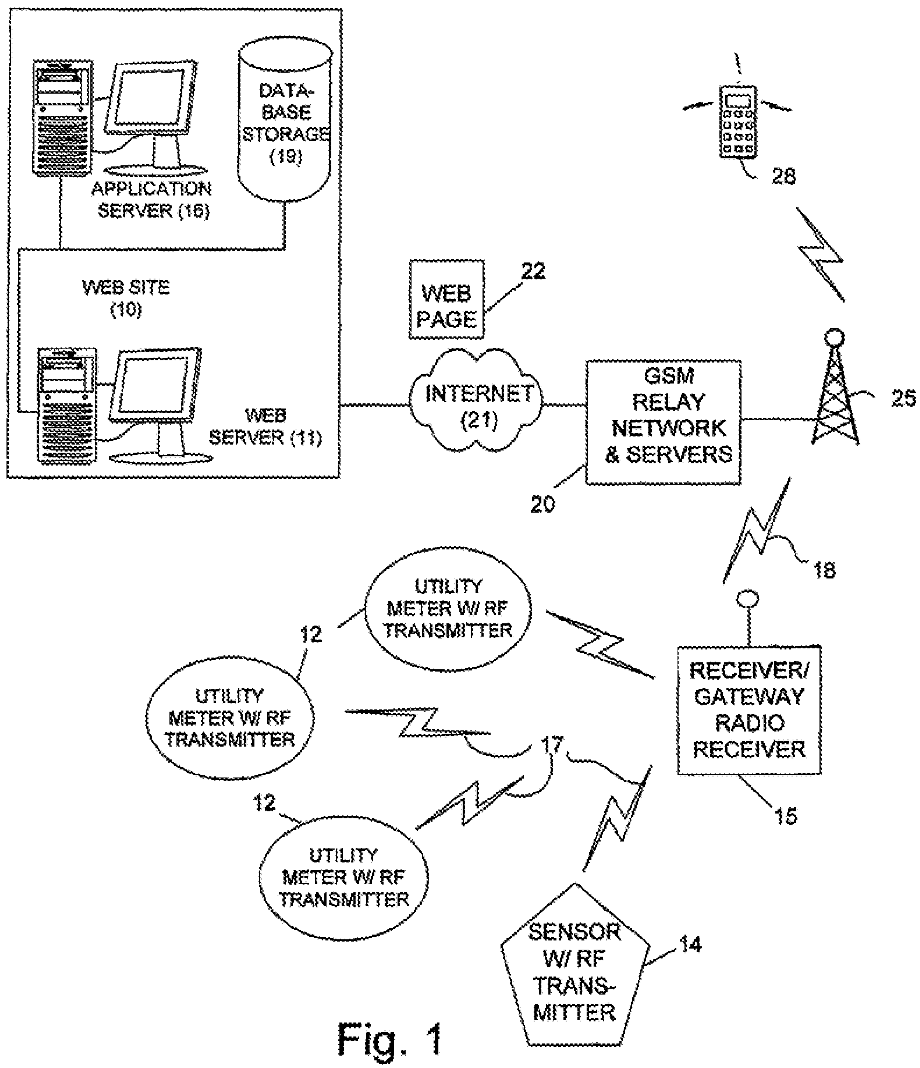
Primary Examiner — Nathan Mitchell
(74) *Attorney, Agent, or Firm* — Boyle Fredrickson, S.C.

(57) **ABSTRACT**

A method and a system for collection of meter readings from meter reading and transmitting devices (**12, 14**) and for viewing on a web-enabled wireless communication device (**28**) comprises addressing at least one receiver (**15**) through the Internet (**21**) and obtaining a data file of meter data for a plurality of meter reading devices (**12, 14**) that have previously communicated with the receiver (**15**). The receiver (**15**) can then re-transmit the meter data through a wide area network such as the Internet (**21**) to a web site (**10**) operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone (**28**) which receives a web page (**22**) that is reduced in size for transmission through the cellular network to the smart phone (**28**).

19 Claims, 2 Drawing Sheets

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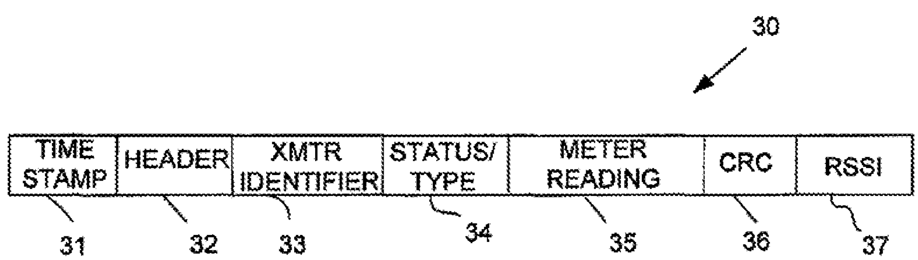
STORAGE
(19)
APPLICATION
SERVER (16)
WEB SITE
(10)
WEB
SERVER (11)
WEB
PAGE
22
INTERNET
(21)
GSM
RELAY
NETWORK
& SERVERS
20
28
25
18
UTILITY
METER W/ RF
TRANSMITTER
12
UTILITY
METER W/ RF
TRANSMITTER
12
UTILITY
METER W/ RF
TRANSMITTER
17
RECEIVER/
GATEWAY
RADIO
RECEIVER
15
SENSOR
W/ RF
TRANS-
MITTER
14

Fig. 1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TIME STAMP
HEADER
XMTR IDENTIFIER
STATUS/ TYPE
METER READING
CRC
RSSI
31
32
33
34
35
36
37

Fig. 2

METHOD AND SYSTEM FOR PROVIDING WEB-ENABLED CELLULAR ACCESS TO METER READING DATA

TECHNICAL FIELD

This invention relates to automatic meter reading (AMR) systems using radio transmitters and receivers for collecting meter data signals over a geographical area, such as a municipality or utility district.

DESCRIPTION OF THE BACKGROUND ART

Fixed network (non-mobile) AMR (automatic meter reading) systems typically involve meters equipped with radio transmitters operating in a local area network with radio receivers, often mounted on a rooftop or a utility pole. The receivers also sometimes operate as gateways, for collecting meter data from the transmitters and then transmitting the meter data through a second network to a central office. The meter data is transmitted from the receivers or gateways to the central office for processing into customer statements of account. Typically, there is at least a network communications computer and an applications computer at the central office of the local utility, although various systems at the collection end are possible and are known in the art.

In the prior art, installing an AMR system included the setting up of a central office data collection system and a database for the meter data.

In the marketing of AMR systems, it would be advantageous to demonstrate the collection of meter reading data before actual installation of the central office data collection system. Prospective customers could then see how the system would work prior to contracting for installation of a large system.

SUMMARY OF THE INVENTION

The invention provides a method and a system for collection of meter readings from meter reading and transmitting devices and for viewing meter data on a web-enabled wireless communication device.

The method comprises addressing at least one receiver through a wide area network, preferably the Internet, to obtain meter data from at least one and usually a plurality of meter reading devices that have previously communicated with the receiver. The receiver can then re-transmit the meter data to a web site operated by the organization marketing AMR systems. The data is then be accessed from a customer demonstration site, preferably using a wireless communication device.

The method and system of the present invention can run on a web site that can be reached through a GSM or other cellular network. The method of the invention further includes reading a file of meter data in the form of an HTML web page, which is then modified for viewing on a web-enabled handheld wireless communication device.

The wireless communication device is preferably a web-enabled wireless communication device, such as a Blackberry web-enabled cellular phone, another web-enabled cellular phone or personal digital assistant (PDA). In alternative embodiments, the web-enabled wireless communication device can also be a laptop with wireless Internet capability, but a handheld wireless processor-based device is considered advantageous and is strongly preferred for convenience and portability.

The invention provides a demonstration tool that can be operated at a customer demonstration site by a sales person as part of a customer presentation without requiring assistance from engineering personnel as practiced in the prior art. The use of a Web application on a web-enabled telephone simulates collection of data at a utility collection site. This will demonstrate the capabilities of the AMR-networked system prior to purchase by utility customers and installation at their premises.

Other objects and advantages of the invention, besides those discussed above, will be apparent to those of ordinary skill in the art from the description of the preferred embodiments which follows. In the description, reference is made to the accompanying drawings, which form a part hereof, and which illustrate examples of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic of a fixed-network AMR system for collecting meter data from transmissions from meter data reading devices and making the data available through a web-enabled cellular device; and

FIG. **2** is a data map of data received from the meter reading devices.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, a network gateway receiver **15** is installed on a roof top (not shown) or on a utility pole (not shown). In this preferred embodiment, the utility is water, however, in other embodiments the utility can be gas or electricity.

A plurality of meter reading devices **12** each include a utility meter, a transducer and an RF (radio frequency) transmitter. In this example, the units **12** can be meter reading and transmitting units commercially offered under the Orion® trademark or the Galaxy® trademark by the assignee of the present invention. These meter reading devices **12** transmit radio frequency (RF) signals **17** to the receiver **15** to form a local area wireless network. It should be understood that there is typically more than one receiver **15** in a network, although only one is illustrated in FIG. **1**. Sometimes the receiver **15** is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network **21**. Alternatively, the meter reading devices **14** may be sensors for sensing other types of conditions at the utility meter or in supply links connected to the utility meters. These sensors may be connected to Orion® or Galaxy® radio transmitters to transmit status data to the receiver **15**.

The meter reading devices **12**, **14** read meter data and certain alarm/condition status data from the meters. As used herein, the term "meter data" should be understood to include either utility consumption data or condition status data, or both. Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.

The devices **12**, **14** transmit data-encoded RF signals over low power RF frequencies either in the non FCC-licensed ISM (Industrial-Scientific-Medical) band from 902 MHz to 928 MHz or in the FCC-licensed frequencies such as 150-200 Mhz, 325 MHz, 433.92 MHz or from 450 to 470 MHz. The meter data transmitters **12**, **14** transmit to an RF receiver **15**, which in this case is a Galaxy® receiver offered by the assignee of the present invention. The receiver **15** is provided with wireless capability to re-broadcast transmissions to a

GSM cellular tower **25**, a GSM network **20** and the Internet **21** to a GSM-networked web site **10**. This web site **10** includes a web server **11** for handling communications in both directions through the Internet **21**, and an applications server **16** for handling the content of pages for communication and display through the Internet **21**. The applications server **16** also stores and accesses data in a database stored in a database storage unit **19**. The database stores a receiver network address, a list of transmitting devices **12**, **14** served by the receiver **15**, a history of readings for the transmitting devices **12**, **14** and a history of readings from the receiver **15**. It should be mentioned here that many architectures are available for web sites using additional servers and these are within the scope of the present invention.

The web site **10** will store the meter data in web pages **22** that can be accessed at an Internet Protocol (IP) addresses having the format XXX.YY.ZZZ, where X, Y and Z are individual numbers from "0" to "9" or preferably at a domain name/URL address of the form http://www.(name).(domain)/ where "(name)" is the site identifier and "(domain)" is a domain such as .com or .(country).

These web pages can be accessed through a GSM relay network and servers **20** that can convert HTML pages to web pages of a type that can be displayed on the visual display portion of a wireless handheld device, such as a BlackBerry™ smart phone, as disclosed in U.S. Pat. No. 7,302,637, issued Nov. 27, 2007, the disclosure of which is incorporated here by reference.

The web site **10** will have its own distinctive domain name or IP address. It can be maintained by the marketing organization or a hosted by a third party on behalf of the marketing organization.

An application program is provided on the handheld wireless device **28** to access the web site **10** and obtain a reduced size version of the web page **22** through the GSM relay network and servers **20**.

When accessed by a user of the handheld device **28**, a log-in screen will appear prompting the user to enter a user name and a password. After logging in, the user will have an option to select a "Monitor" mode or a "Data View" mode. A search screen will also be available to allow the user to find the data for a specific transmitter. The web site **10** is addressed and a web page **22** of data is transmitted from the web site **10** to the web-enabled wireless device **28** through the Internet **21** and is converted to a reduced size web page as the web page **22** is transferred through the GSM relay network and servers **20**. On the handheld device **28**, a reduced size "Monitor" web page **22** will display the last transmissions that were received by the receiver/gateway **15** from the meter/transmitters **12**. The data displayed on the "Monitor" web page will include the transmitter number, the time of reception and an indication of signal strength (by a graphic representation of the RSSI). By selecting a line on the screen display of the web-enabled wireless device, the user can cause a display of a history of daily transmissions received from a specific transmitter.

The data is preferably displayed in a WAP format supported by web-enabled smart phone devices such as a BlackBerry™ smart phone. Each line of data contains data received from one of the transmitters. FIG. **2** shows a map of each line of data **30** in a web page **22**. There is a first item of data **31** which is a time stamp for the individual meter reading device **12**, **14**. Next, there is a header **32**. This is followed by an item of data **33** representing the identifier, such as a serial number of the transmitter which corresponds to each meter reading device **12**, **14**. Next, there is a status or type item of data **34** which identifies one of several types of meter reading devices **12**, such as an RTR® pulse register/transmitter type, an ADE® digital encoder type, or gas meter registers, or other designations for completely electronic registers. This is followed by the actual meter data or status condition data, as represented by item **35**. This is followed by a CRC item of data **36**, which is a cyclic redundancy code or error checking code computed from the data earlier in line of data. Finally, a radio signal strength indicator (RSSI) item of data **37** is provided from each meter reading device **12**, **14** for radio network diagnostics purposes.

As seen from the above description, the invention provides for easier demonstration of the data collection abilities of an AMR system on a handheld wireless processor-based device, thereby saving labor and installation cost and providing ease of use to the marketing organization and the utility customer.

This has been a description of the preferred embodiments, but it will be apparent to those of ordinary skill in the art that variations may be made in the details of these specific embodiments without departing from the scope and spirit of the present invention, and that such variations are intended to be encompassed by the following claims.

We claim:

1. A method for collection of meter data through a wide area network from at least one receiver communicating in a local network with at least one meter reading device in a geographic area, the method comprising:

receiving data, including utility consumption data and condition status data, through the wide area network at a web site from the receiver that includes meter data from at least one meter reading device that has previously communicated with the receiver;

storing the meter data at the web site; and

accessing the meter data at the web site using a wireless communication device at a customer demonstration site and displaying the condition status data on a display portion of the wireless communication device, wherein the condition status data includes at least one of leak detection data, tamper data, radio signal strength, and shut-off valve data.

2. The method of claim **1**, wherein the meter data is accessed by an application program on the wireless communication device that displays the meter data as a reduced size web page.

3. The method of claim **2**, wherein the wireless communication is a handheld web-enabled phone device.

4. The method of claim **3**, wherein the handheld web-enabled phone device communicates through a GSM cellular network.

5. The method of claim **2**, wherein the meter data is received at the web site as an HTML web page and is stored at the web site.

6. The method of claim **5**, wherein the wide area network is the Internet.

7. The method of claim **1**, wherein the meter reading devices include devices for reading condition status data related to a meter or to supply links connected to the meter, and wherein the meter data includes condition status data.

8. A system for displaying meter reading data collected from at least one reading device in a geographic area, the system comprising: a web site for receiving and storing a data file through a wide area network from the at least one receiver that includes meter reading data, including utility consumption data and condition status data, from a plurality of meter reading devices that have previously communicated with the receiver; and an application program for a web-enabled cellular phone for displaying condition status data communicated from a web site accessible through a cellular network,

wherein the condition status data includes at least one of leak detection data, tamper data, radio signal strength, and shut-off valve data.

9. The system of claim **8**, wherein the application program displays the meter data as a reduced size web page on a display portion of the web-enabled cellular phone.

10. The system of claim **8**, wherein web-enabled cellular phone communicates through a GSM cellular network.

11. The system of claim **8**, wherein the meter data is received at the web site as an HTML web page and is stored at the web site.

12. The system of claim **11**, wherein the wide area network is the Internet.

13. The system of claim **8**, wherein the meter reading devices include devices for reading condition status data related to a meter or to supply links connected to the meter, and wherein the meter data includes condition status data.

14. A method for collection of meter data through a wide area network from at least one receiver communicating in a local network with at least one meter reading device in a geographic area, the method comprising:

receiving data through the wide area network at a web site from the receiver that includes meter data from at least one meter reading device that has previously communicated with the receiver;

storing the meter data at the web site;

receiving a request to display the meter data at the web site from a wireless communication device; and

transmitting the meter data for dig lay on a display portion of the wireless communication device, wherein the meter data includes a plurality of meter readings for at least one meter reading device that have been transmitted at a defined time interval,

wherein receiving a request to display the meter data at the web site from a wireless communication device includes selection of a link displayed on a web page specific to the at least one meter reading device.

15. The method of claim **14**, wherein the meter data is displayed on the display portion as a reduced size web page.

16. A method for collection of meter data through a wide area network from at least one receiver communicating in a local network with at least one meter reading device in a geographic area, the method comprising:

receiving data through the wide area network at a web site from the receiver that includes meter data from at least one meter reading device that has previously communicated with the receiver;

storing the meter data at the web site;

receiving a request to display the meter data at the web site from a wireless communication device; and

transmitting the meter data for display on a display portion of the wireless communication device, wherein the meter data includes a plurality of meter readings for at least one meter reading device that have been transmitted at a defined time interval, wherein the meter data includes an indication of signal strength.

17. The method of claim **16**, wherein the indication of signal strength includes an indication of signal strength for each defined time interval.

18. The method of claim **17**, wherein the defined time interval is daily.

19. A method for collection of meter data through a wide area network from at least one receiver communicating in a local network with at least one meter reading device in a geographic area the method comprising:

receiving data through the wide area network at a web site from the receiver that includes meter data from at least one meter reading device that has previously communicated with the receiver;

storing the meter data at the web site;

receiving a request to display the meter data at the web site from a wireless communication device; and

transmitting the meter data for display on a display portion of the wireless communication device, wherein the meter data includes a plurality of meter readings for at least one meter reading device that have been transmitted at a defined time interval,

wherein the at least one meter reading device includes a least one device for reading condition status data related to a meter or to supply links connected to the meter, and wherein the meter data includes condition status data.

* * * * *

US008833390B2

(12) **United States Patent**
Ball et al.

(10) **Patent No.: US 8,833,390 B2**
(45) **Date of Patent: Sep. 16, 2014**

(54) **VALVE METER ASSEMBLY AND METHOD**

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(73) Assignee: **Mueller International, LLC**, Atlanta, GA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 686 days.

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(22) Filed: **May 31, 2011**

(65) **Prior Publication Data**

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(51) **Int. Cl.**

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G01F 15/00	(2006.01)
E03B 7/07	(2006.01)
G01F 15/06	(2006.01)
G01F 3/12	(2006.01)

(52) **U.S. Cl.**

CPC ***G01F 15/14*** (2013.01); *E03B 7/072* (2013.01); ***G01F 15/003*** (2013.01); ***G01F 15/005*** (2013.01); ***G01F 15/066*** (2013.01); ***G01F 15/065*** (2013.01); ***G01F 15/061*** (2013.01); ***G01F 3/12*** (2013.01)

USPC **137/552**; 73/198

(58) **Field of Classification Search**

CPC E03B 7/072; E03B 7/075; E03B 7/078; G01F 3/12; G01F 12/003; G01F 15/005; G01F 15/061; G01F 15/065; G01F 15/066; G01F 15/14

USPC 137/486, 551, 552, 554; 73/198, 201

See application file for complete search history.

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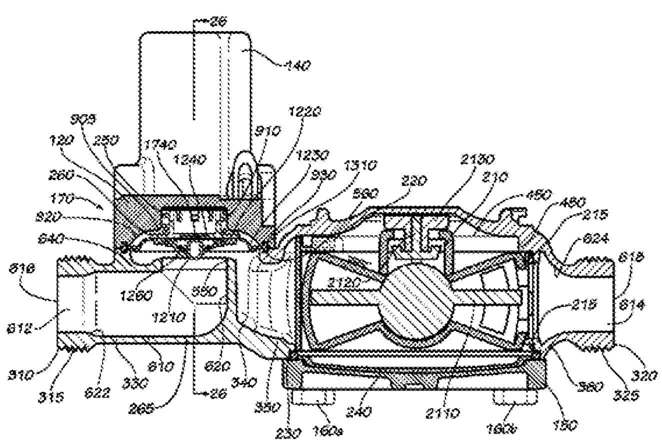
Primary Examiner — John Rivell
(74) *Attorney, Agent, or Firm* — Taylor English Duma LLP

(57) **ABSTRACT**

A valve meter device, assembly, and method is disclosed including a housing defining at least one inlet opening and at least one outlet opening and a channel connecting the openings, the at least one inlet opening having an inlet end and the at least one outlet opening having an outlet end; a water meter positioned in the channel, the water meter configured to monitor a flow of water through the valve meter device; and a valve in communication with the channel and configured to control the flow of water through the valve meter device. In some embodiments, a linear distance exists between the inlet end and the outlet end, the linear distance being no greater than a standard water meter lay-length.

20 Claims, 25 Drawing Sheets



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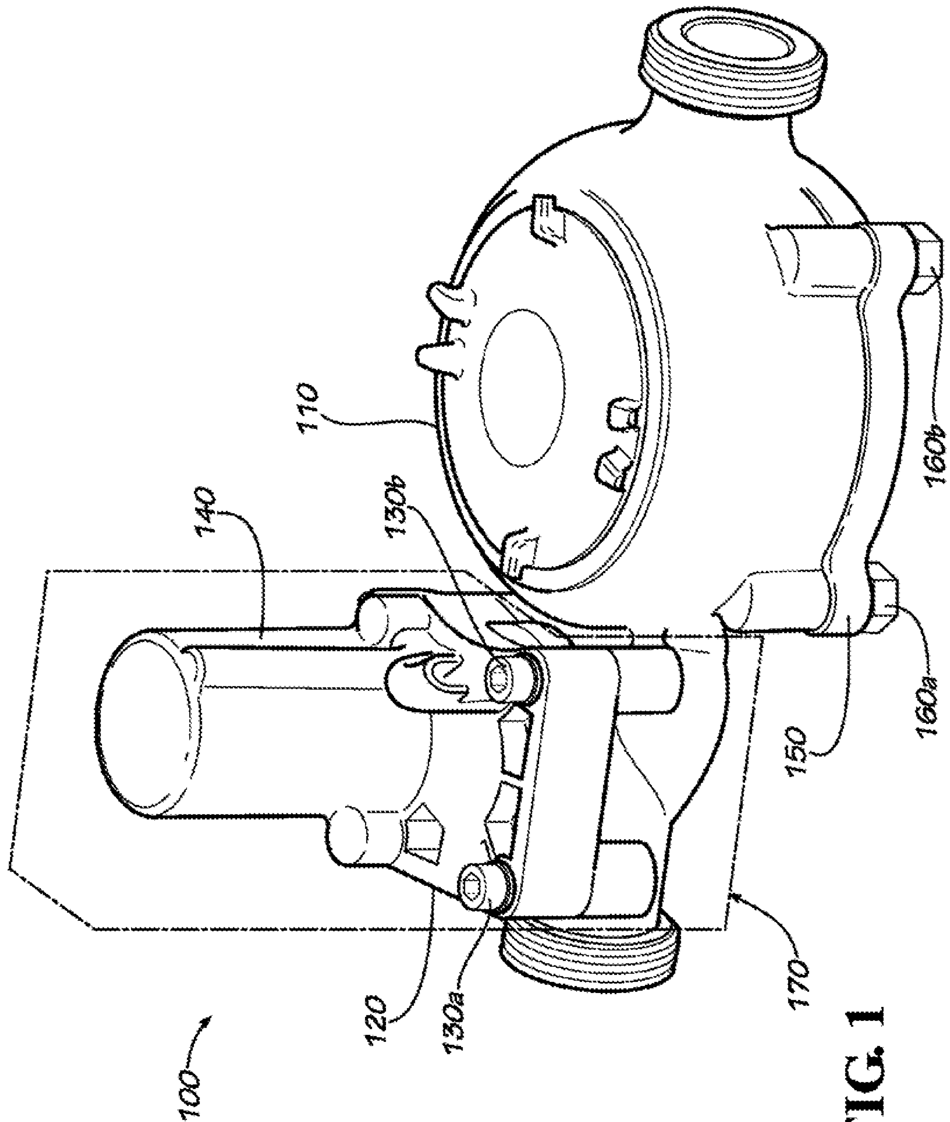

FIG. 1

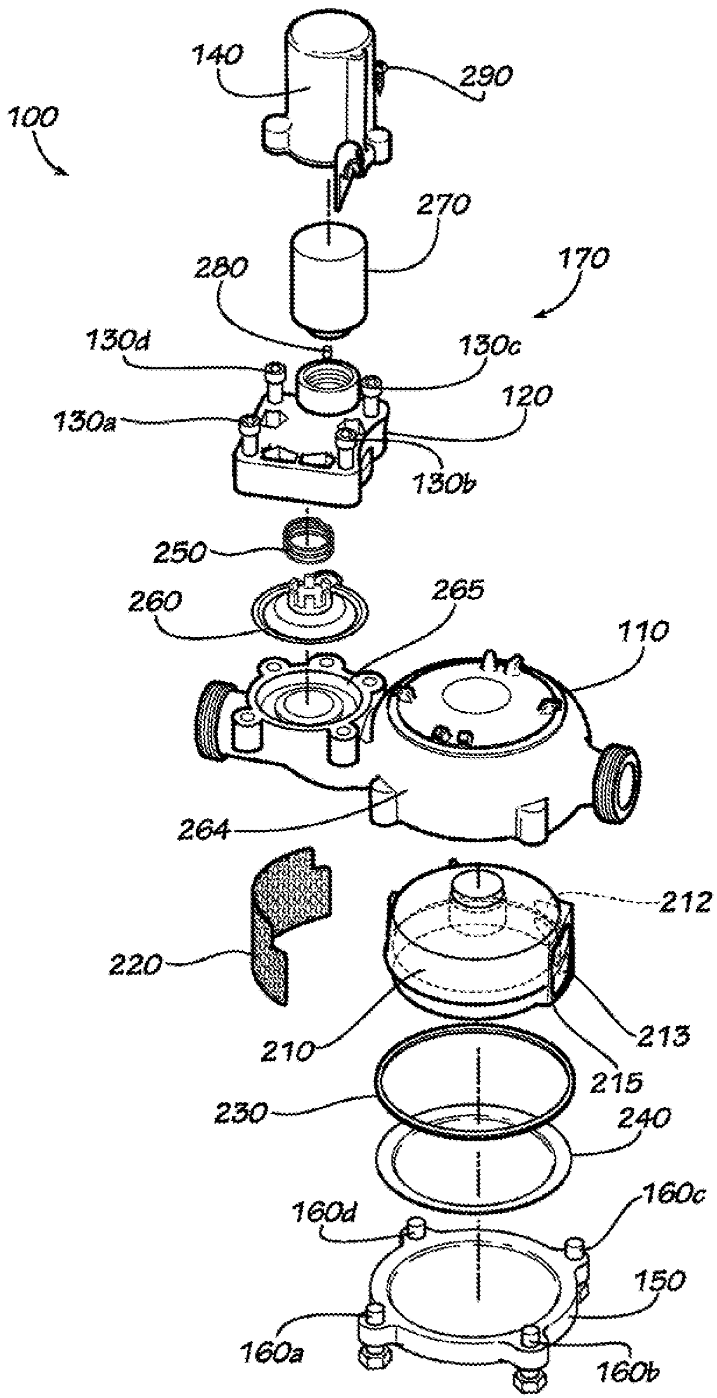
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FIG. 2

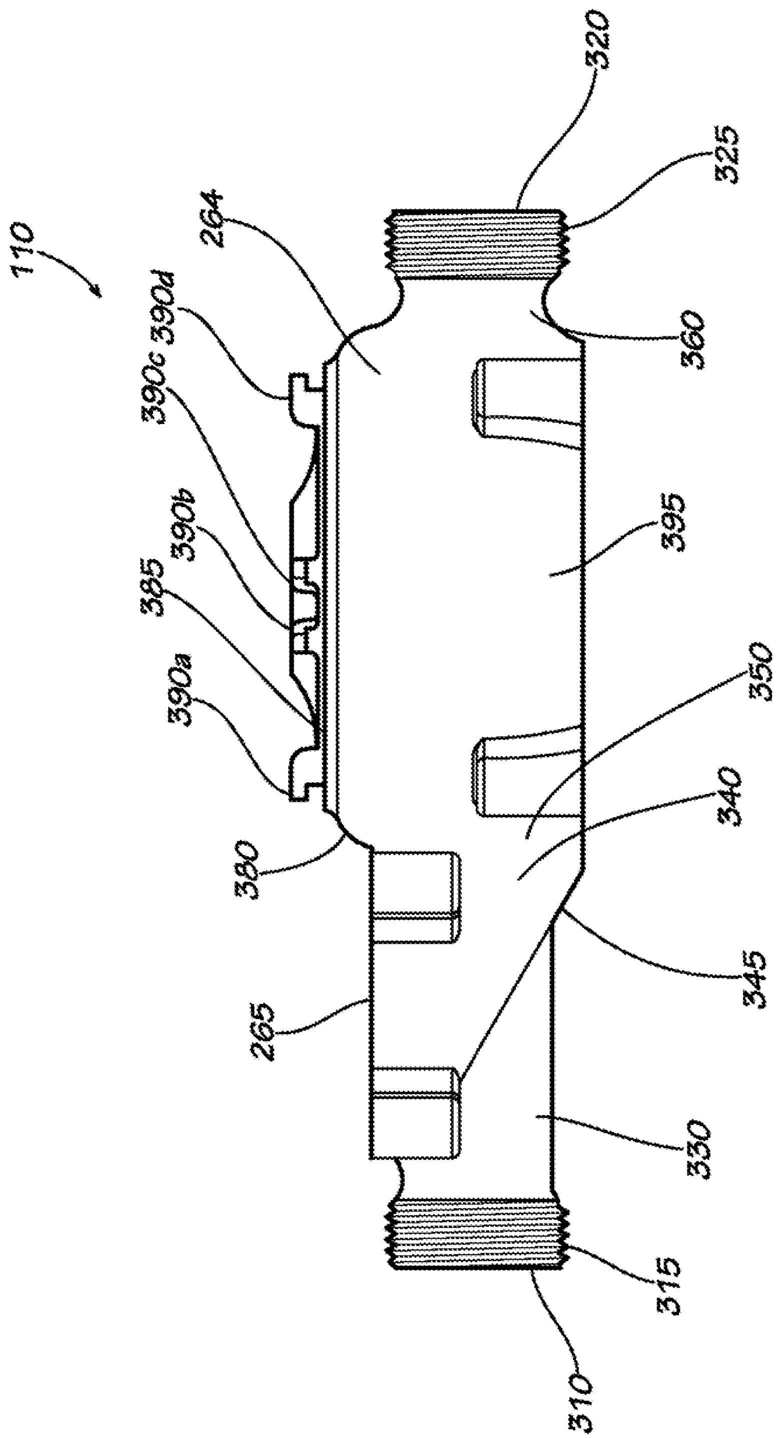
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FIG. 3

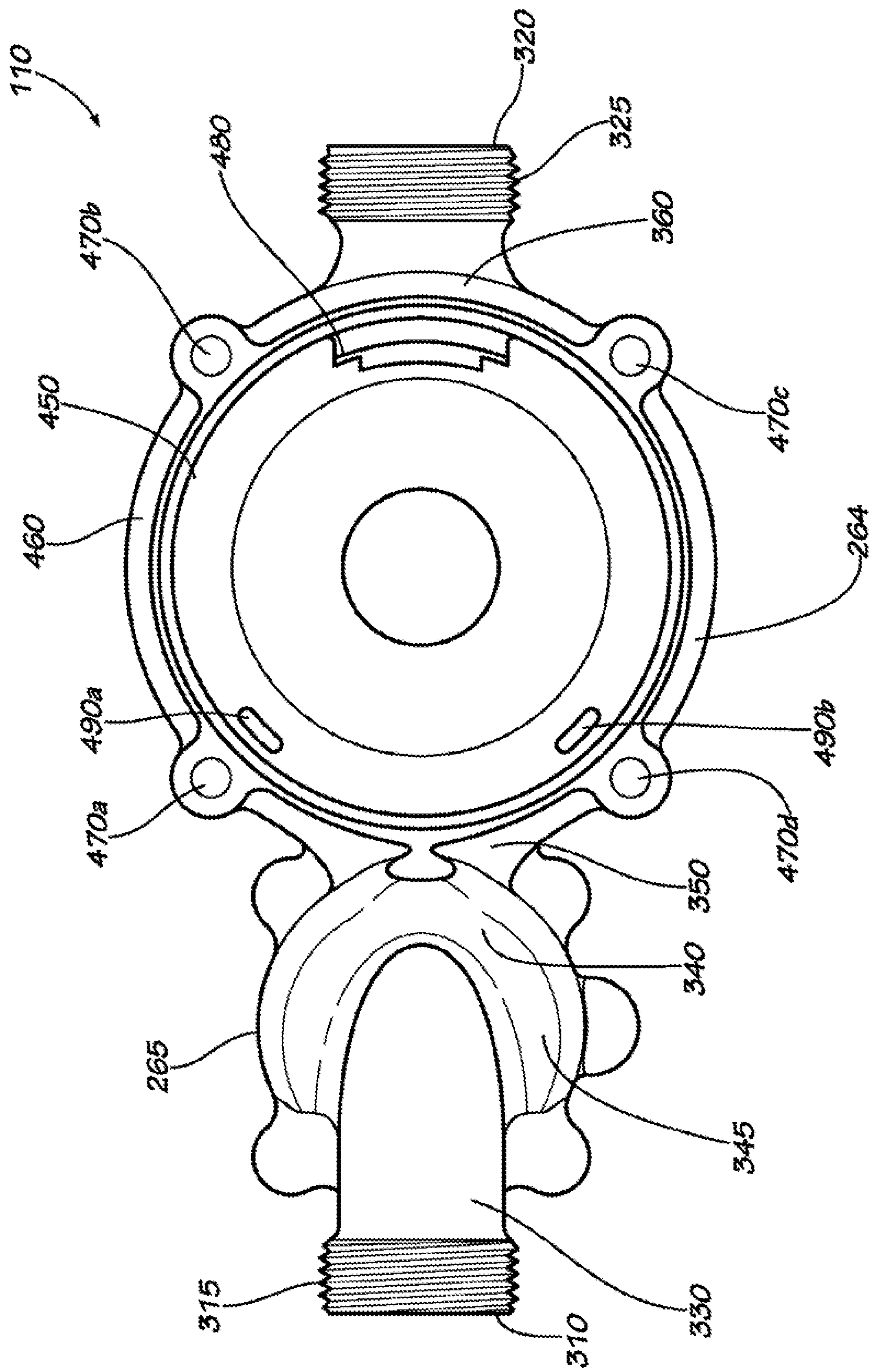
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FIG. 4

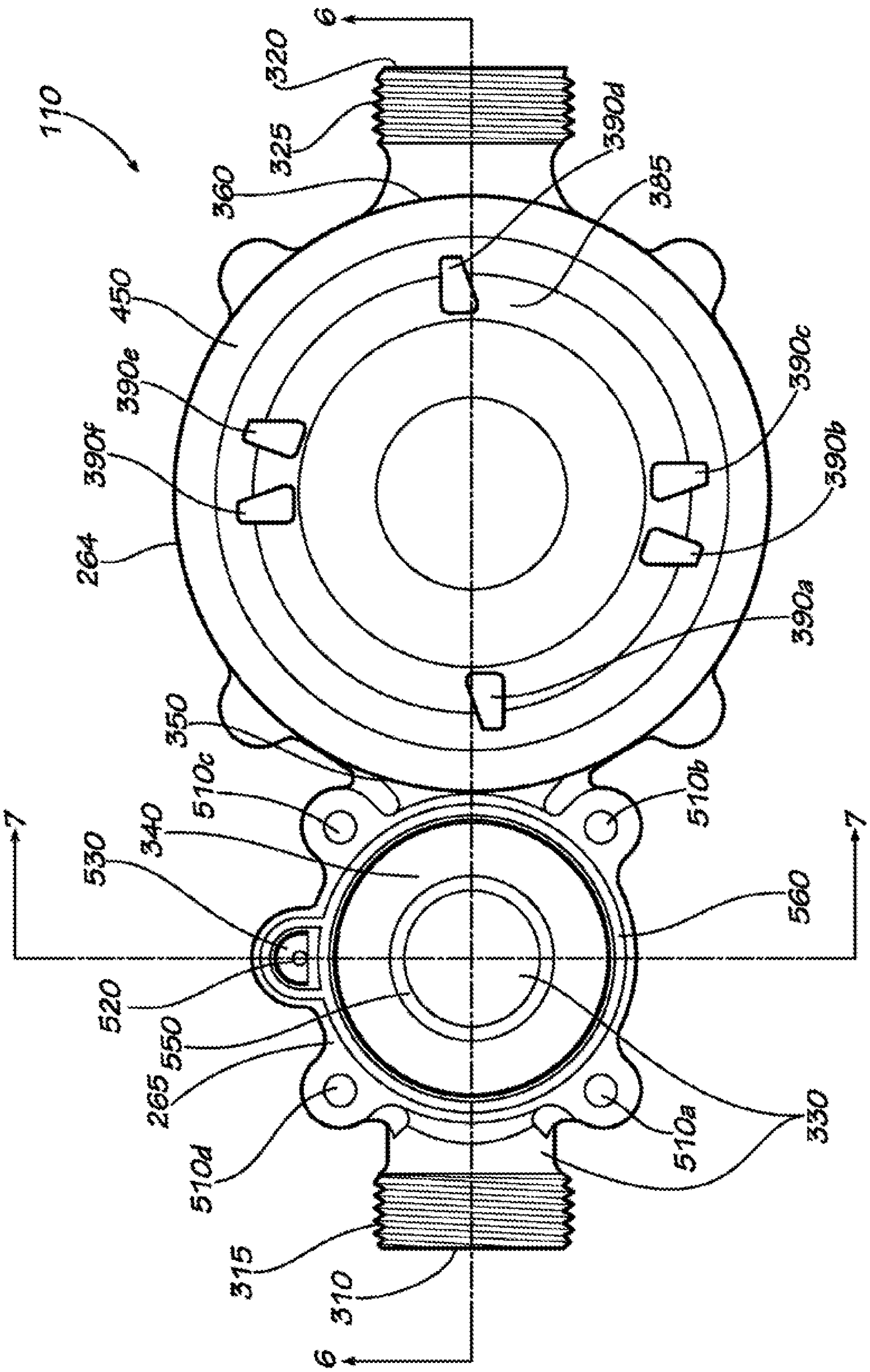
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FIG. 5

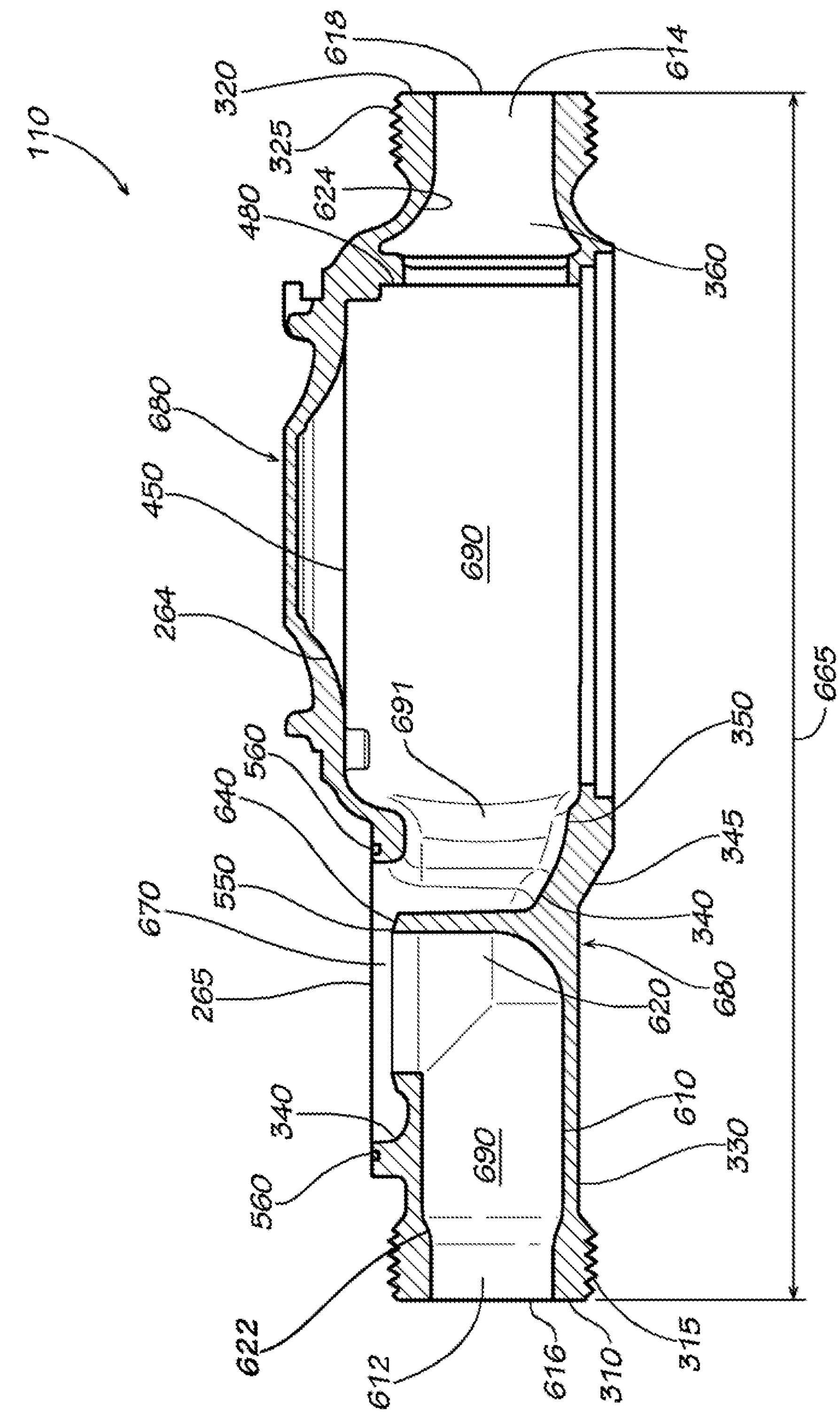
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FIG. 6

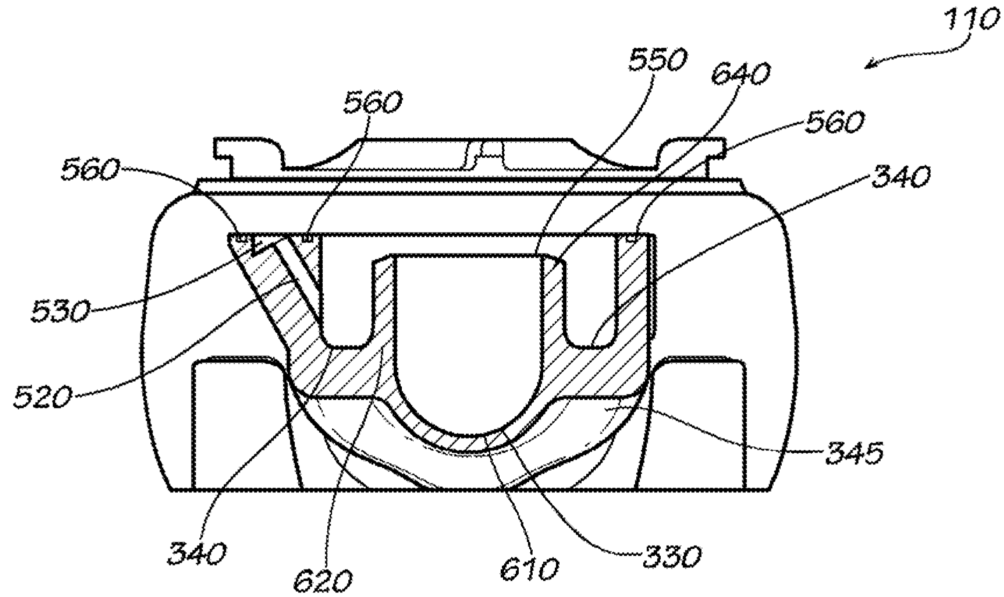
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FIG. 7

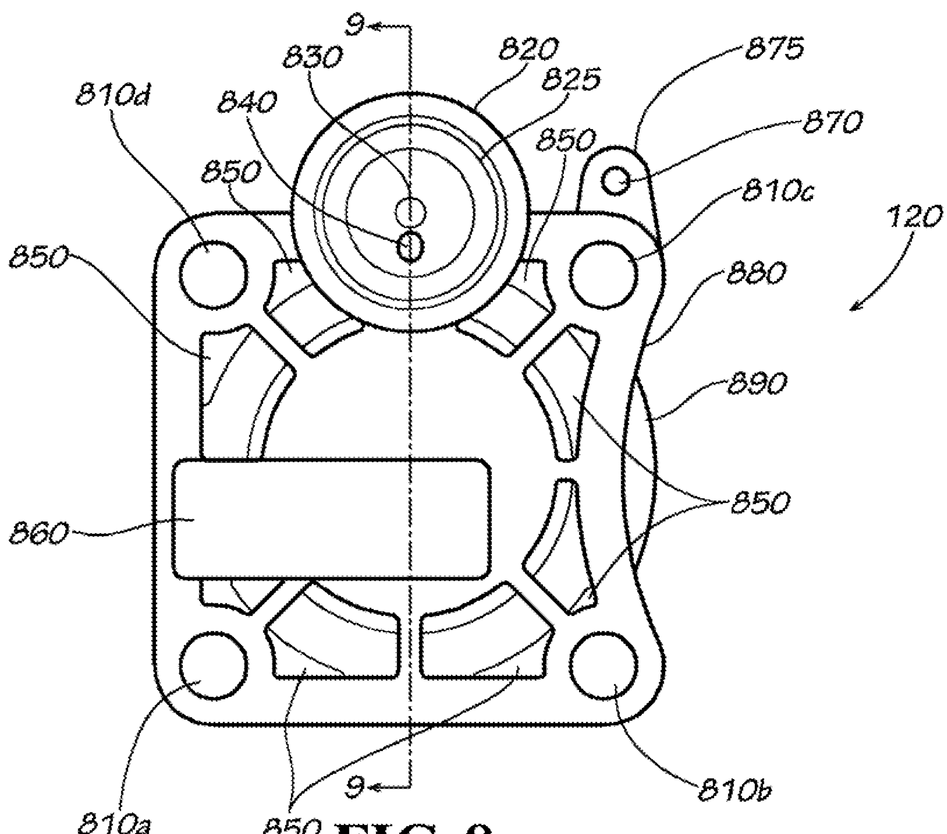
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FIG. 8

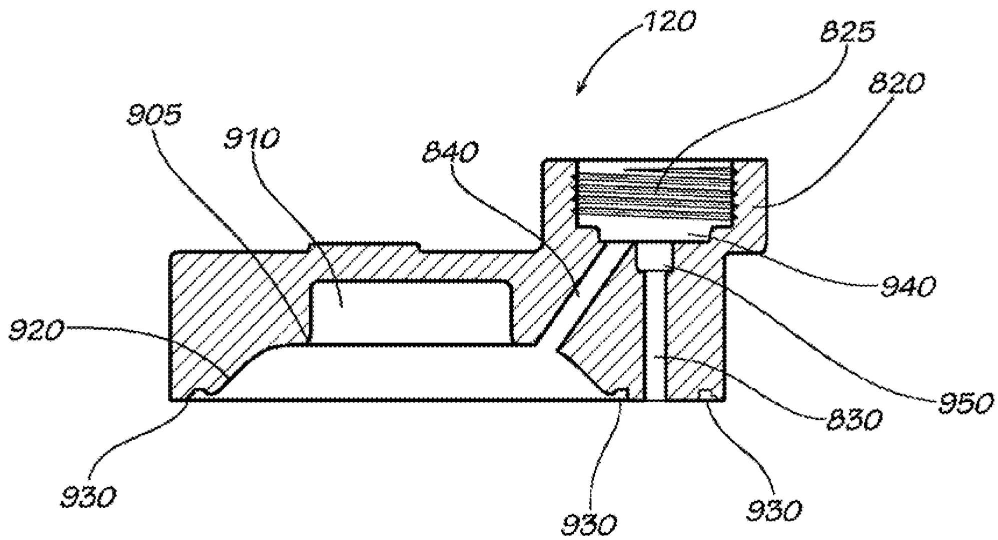
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FIG. 9

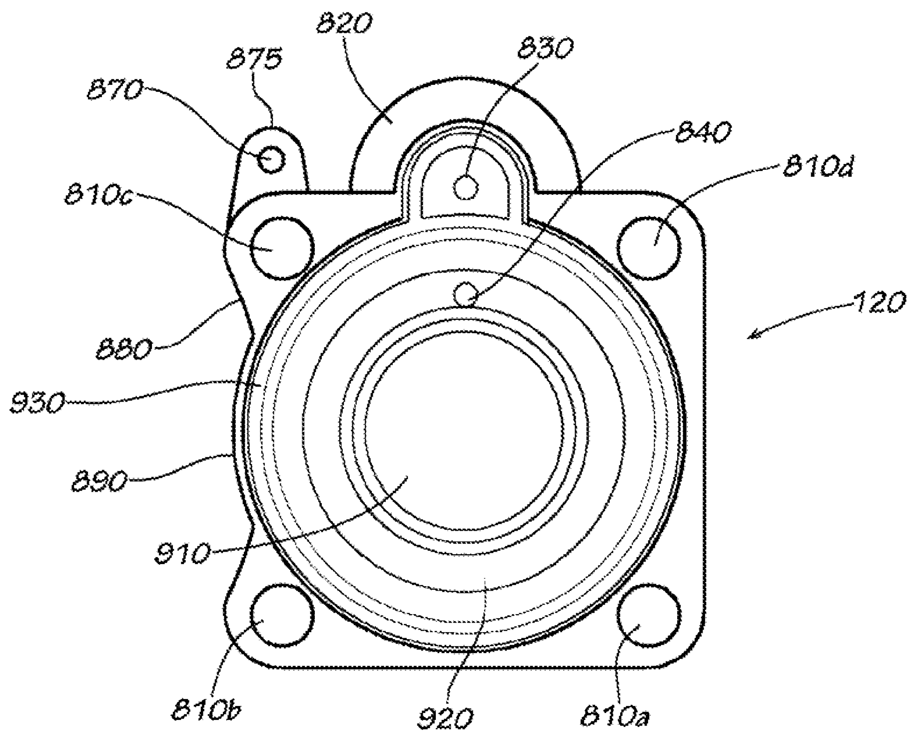
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FIG. 10

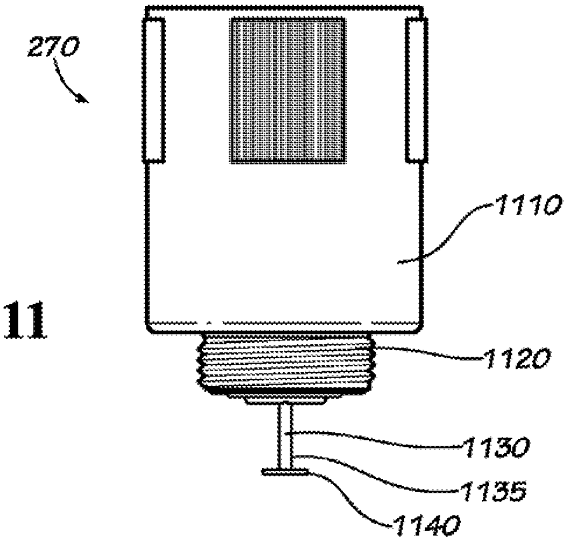
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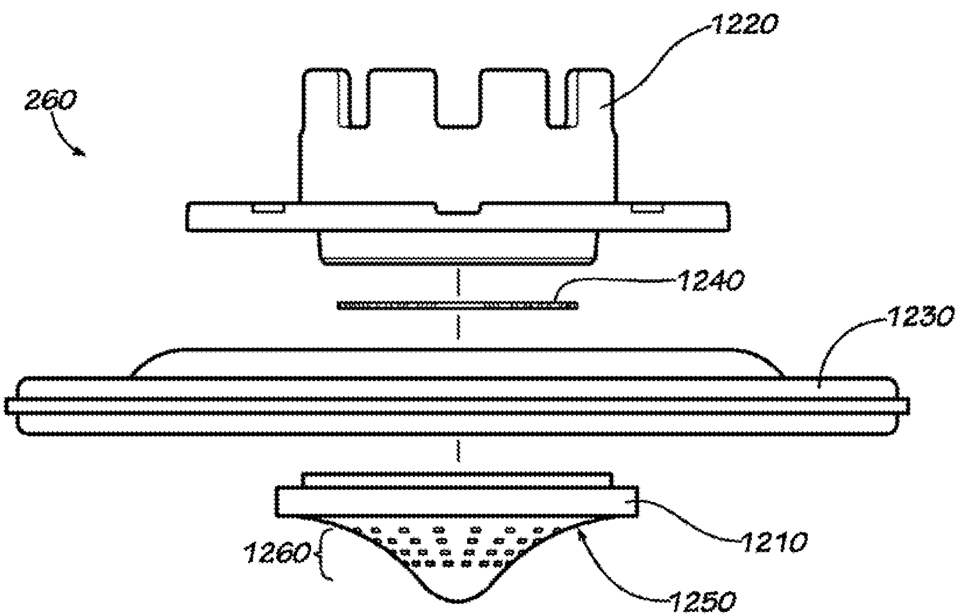
FIG. 11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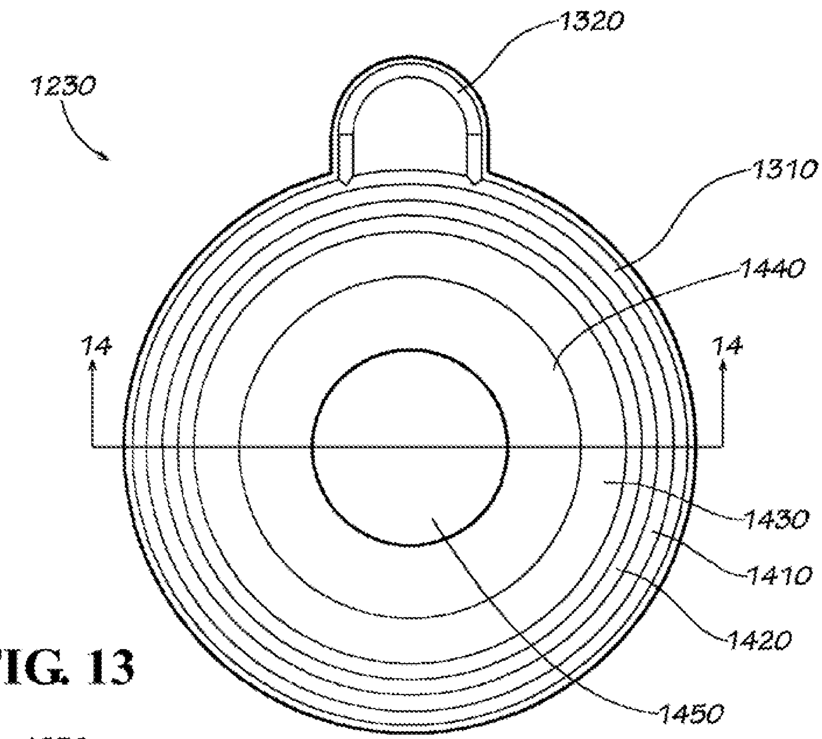
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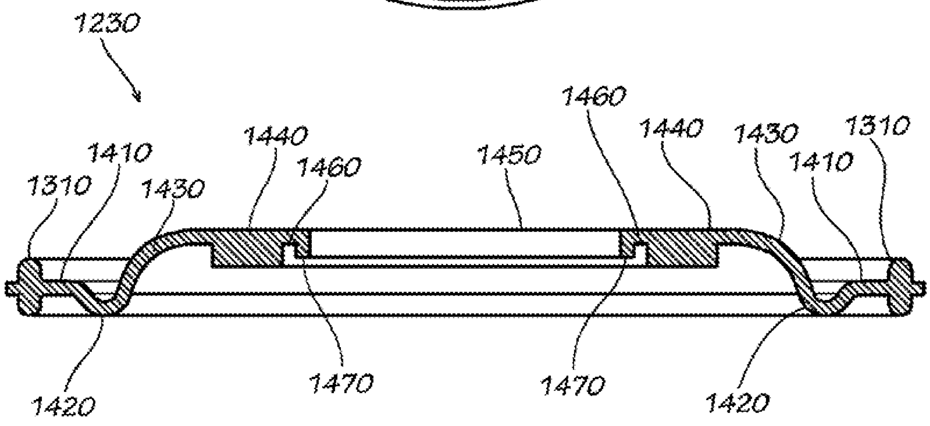
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FIG. 14

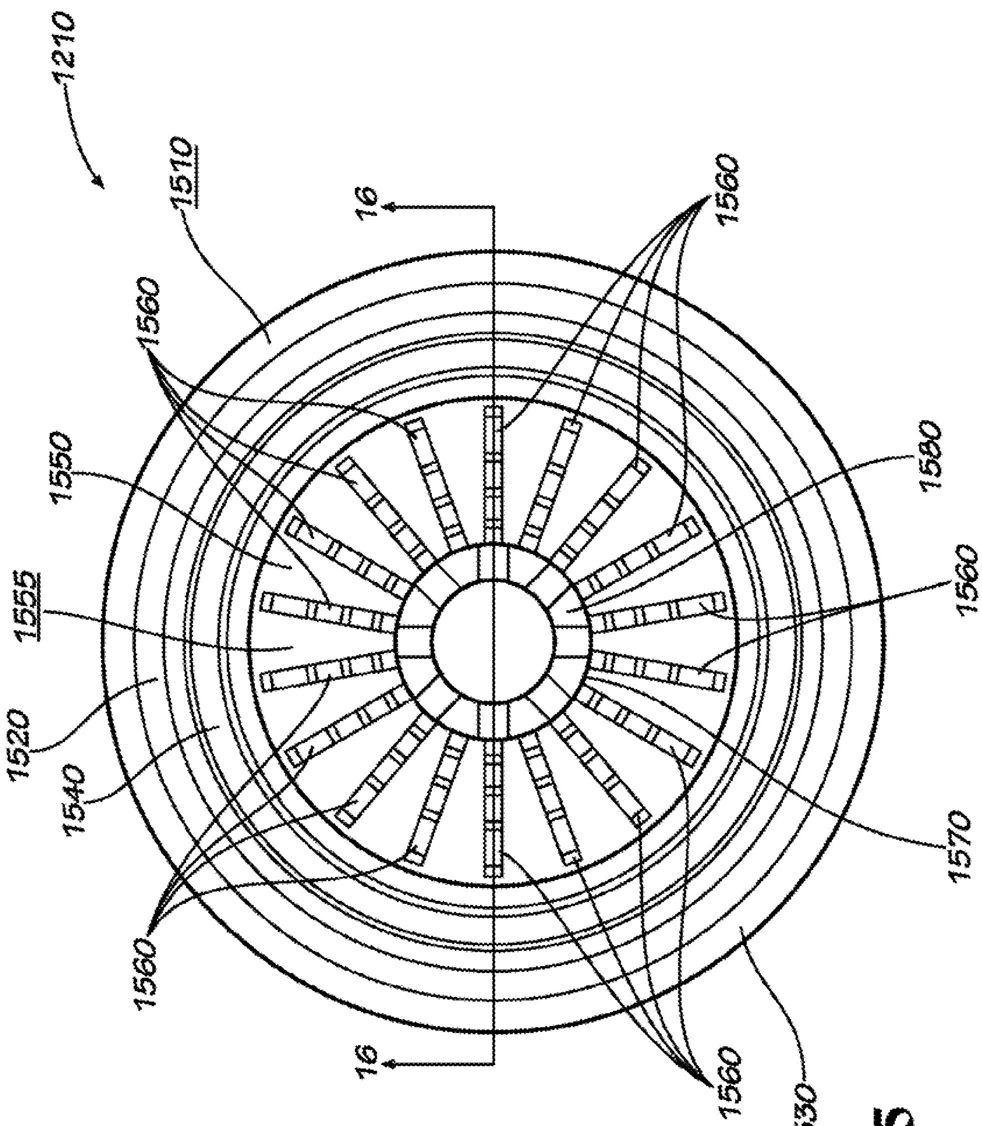

FIG. 15

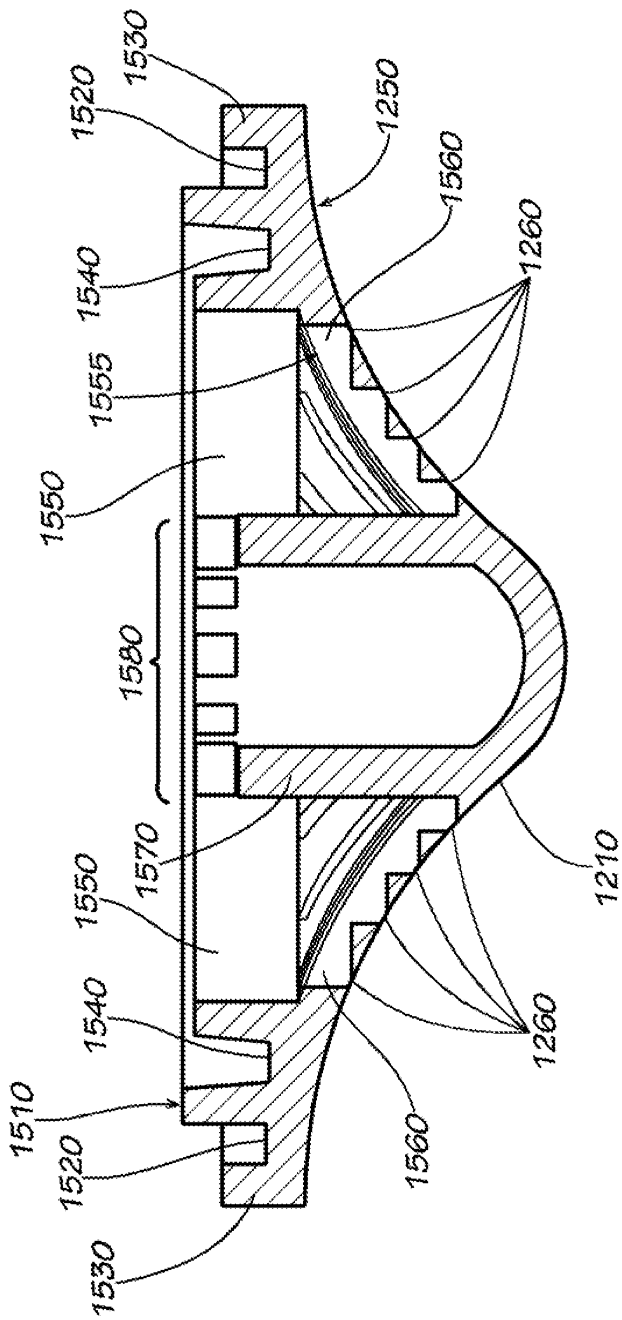
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FIG. 16

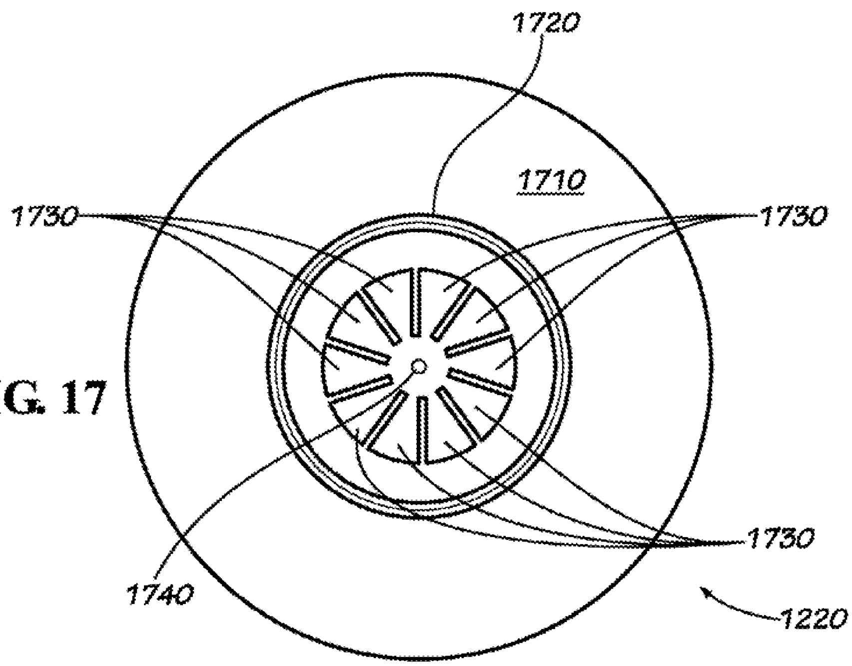
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FIG. 17

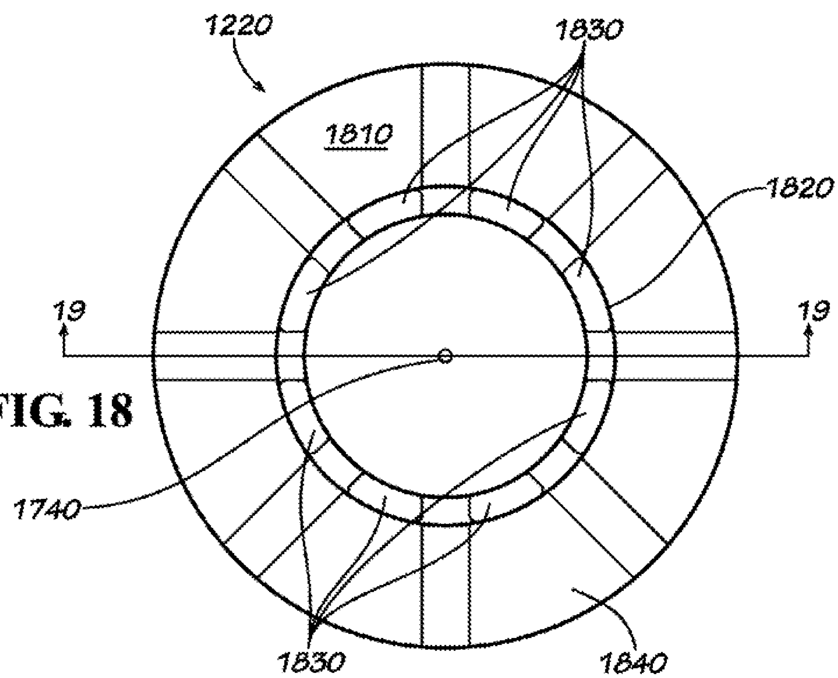
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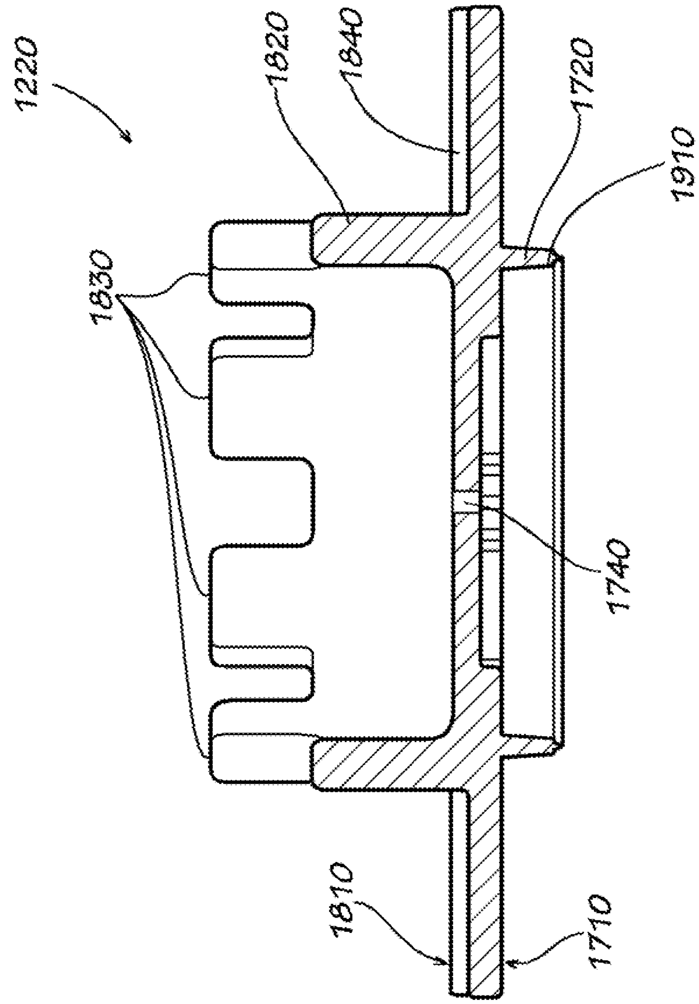
FIG. 18



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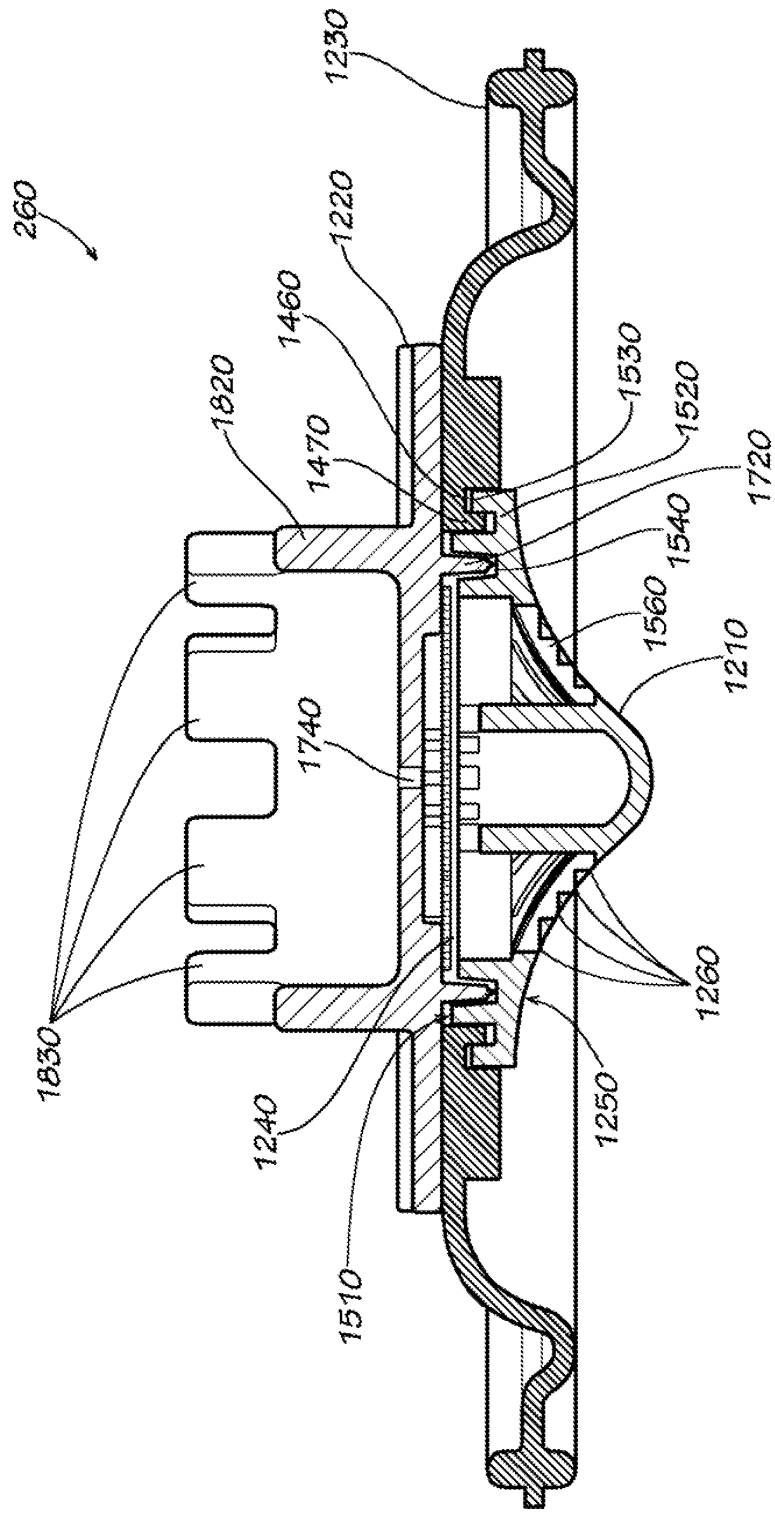
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FIG. 20

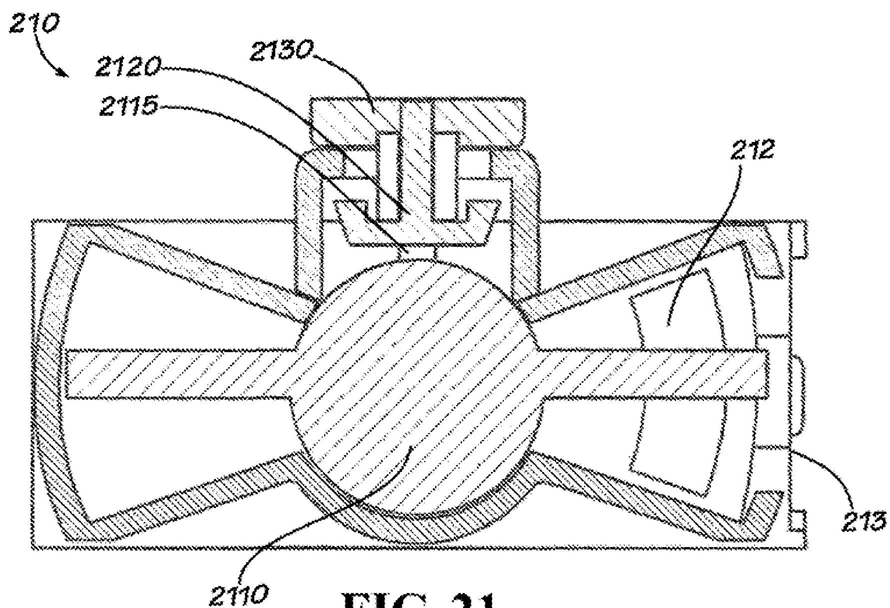

FIG. 21

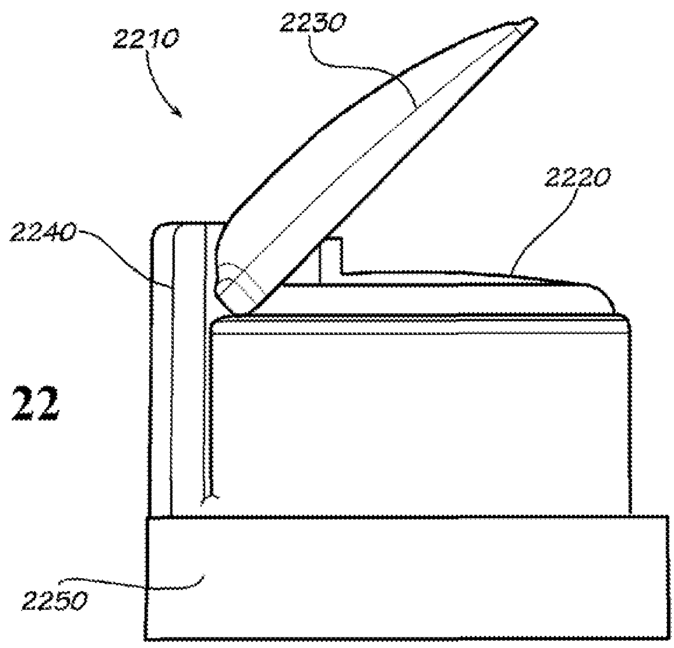

FIG. 22

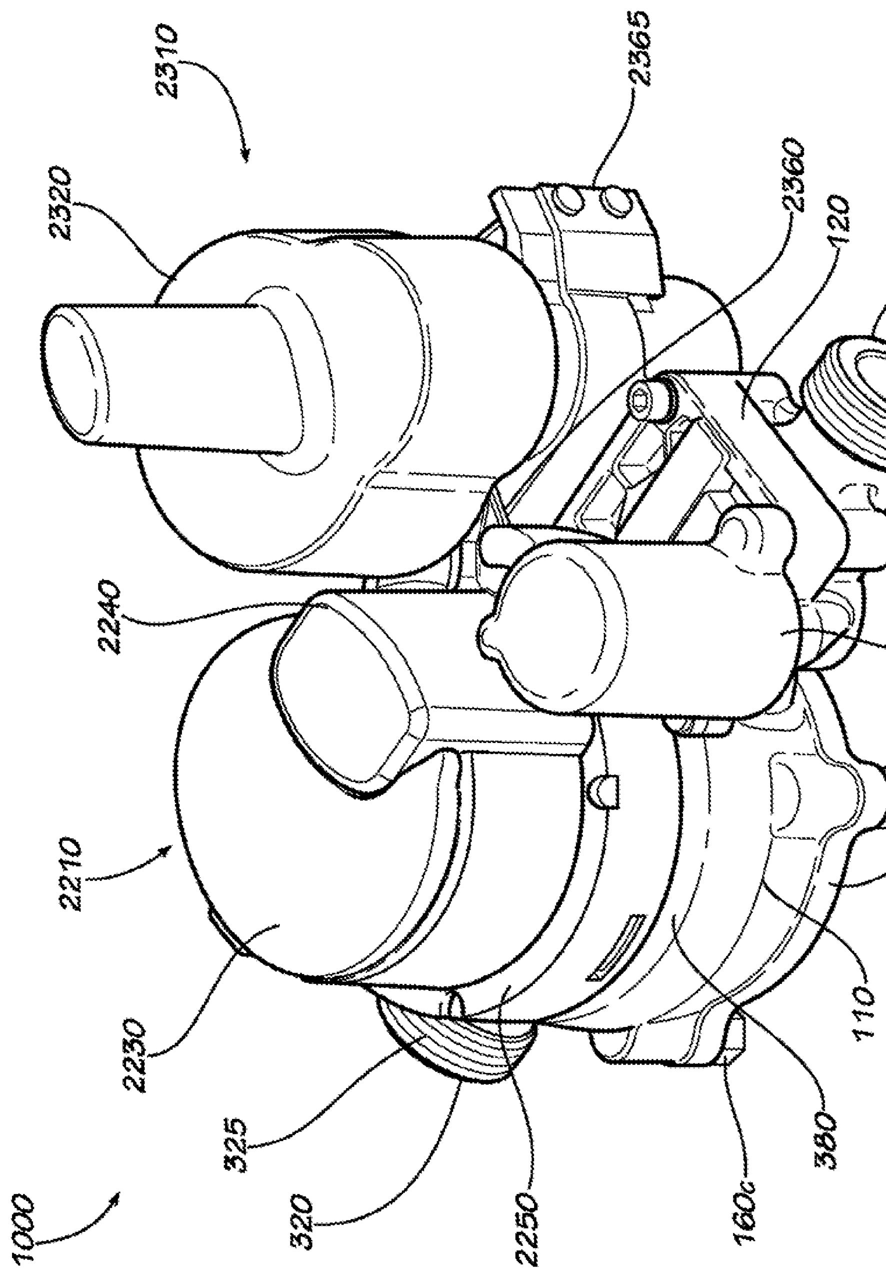
2310
2365
2320
2360
120
310
315
2240
140
160d
2210
150
110
2230
325
320
2250
160c
380
1000

FIG. 23

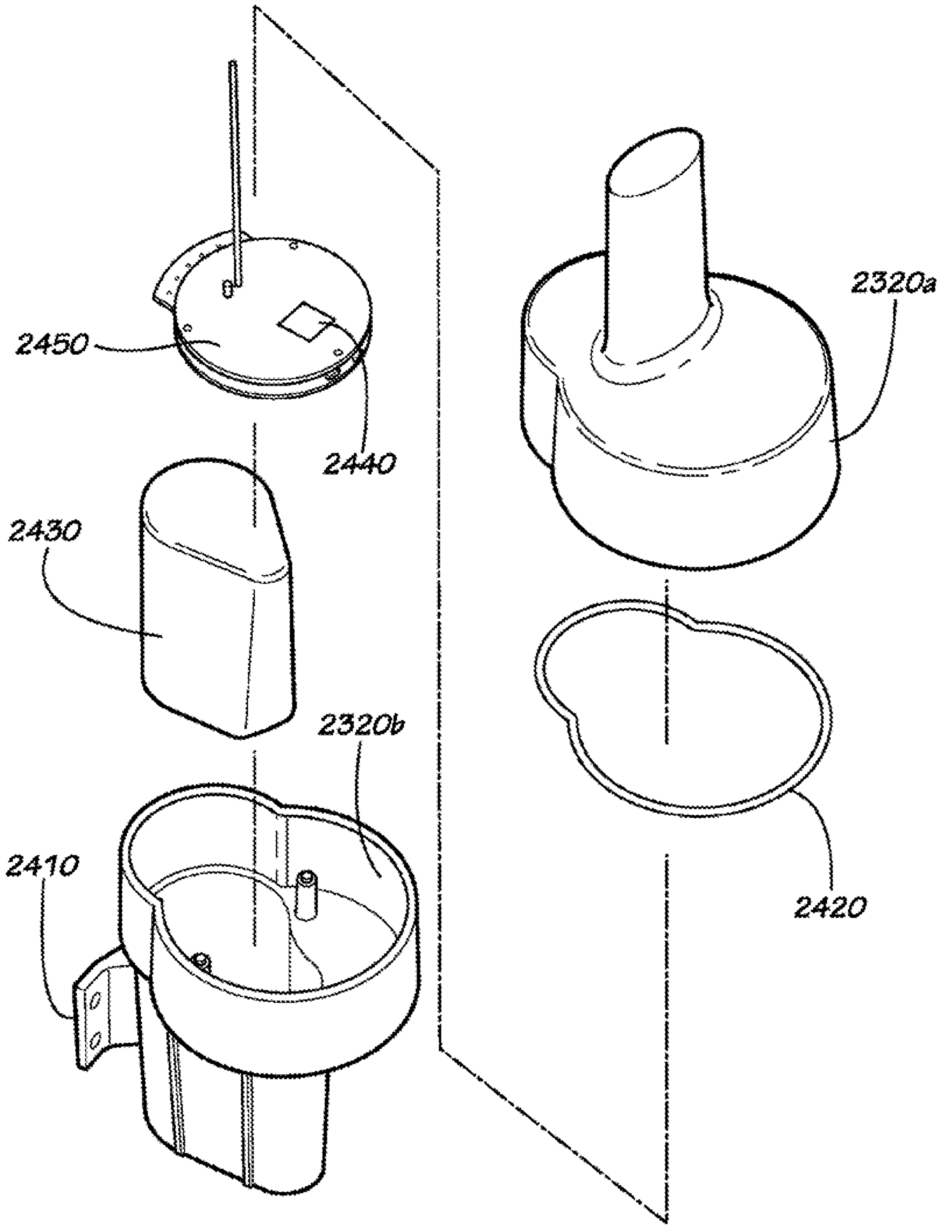

FIG. 24

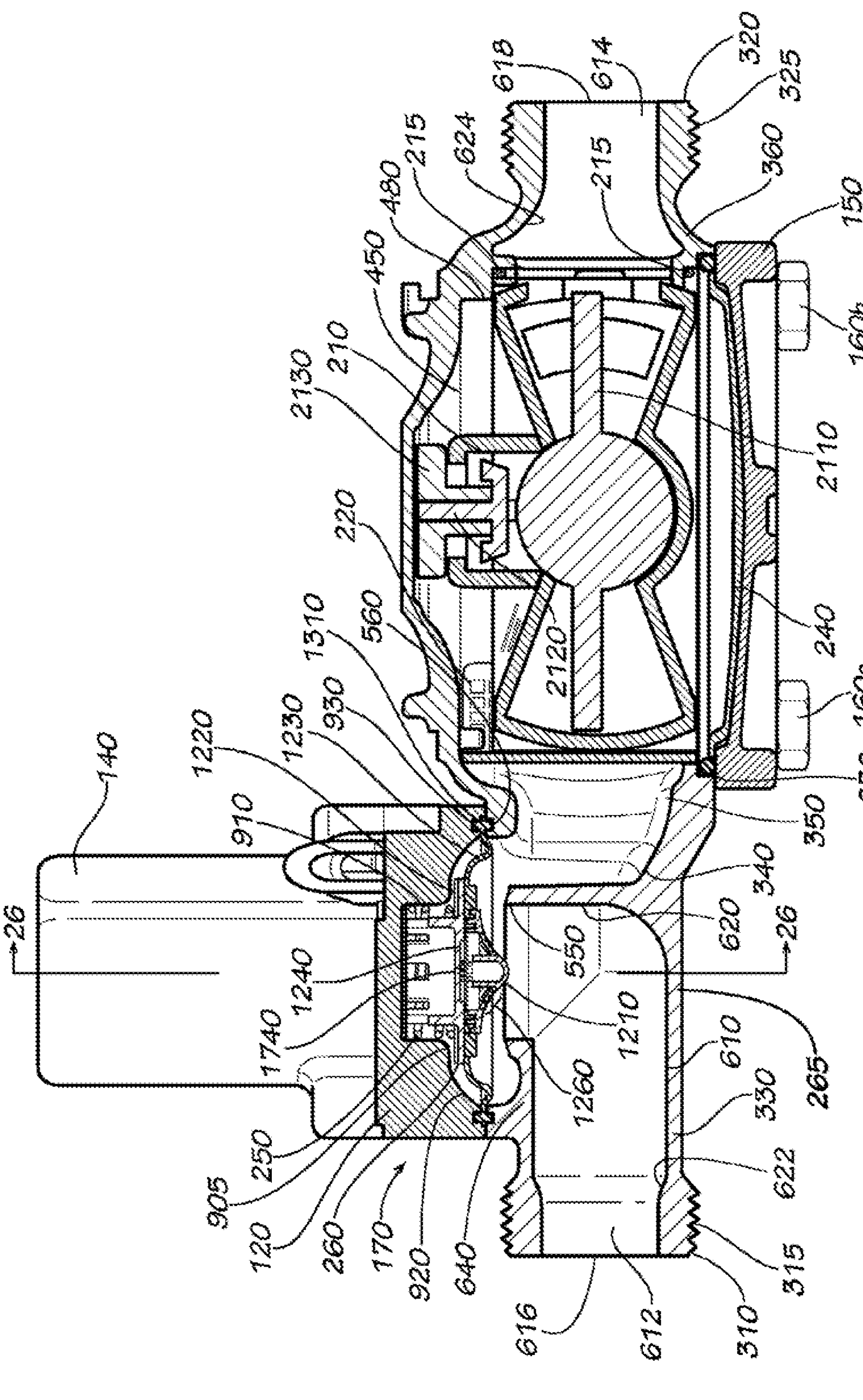
320
325
618
614
624
215
480
215
360
150
450
210
2130
160b
2110
220
560
1310
2120
240
160a
930
1230
1220
140
910
230
350
340
26
26
620
550
1240
1740
1210
610
265
1260
330
250
905
622
120
260
170
920
640
315
616
612
310

FIG. 25

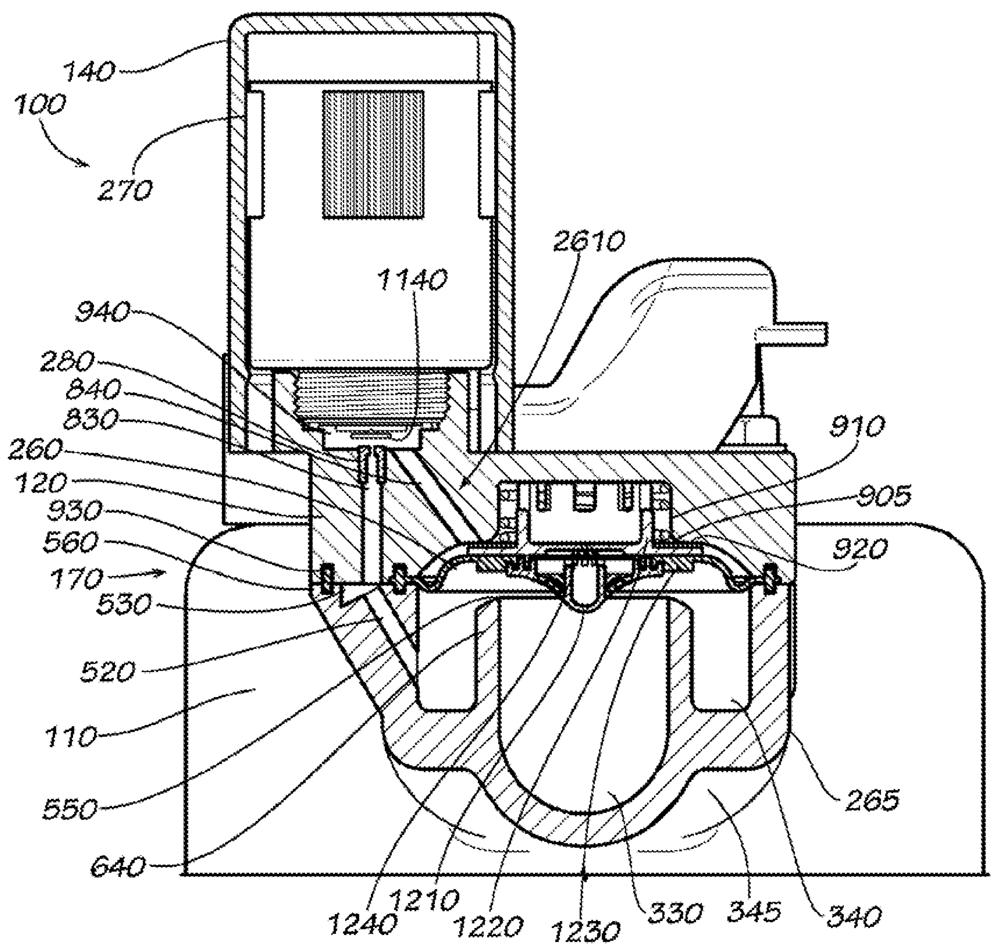
140
100
270
2610
1140
940
280
840
830
260
120
930
560
170
530
520
110
550
640
910
905
920
265
1240
1210
1220
1230
330
345
340

FIG. 26

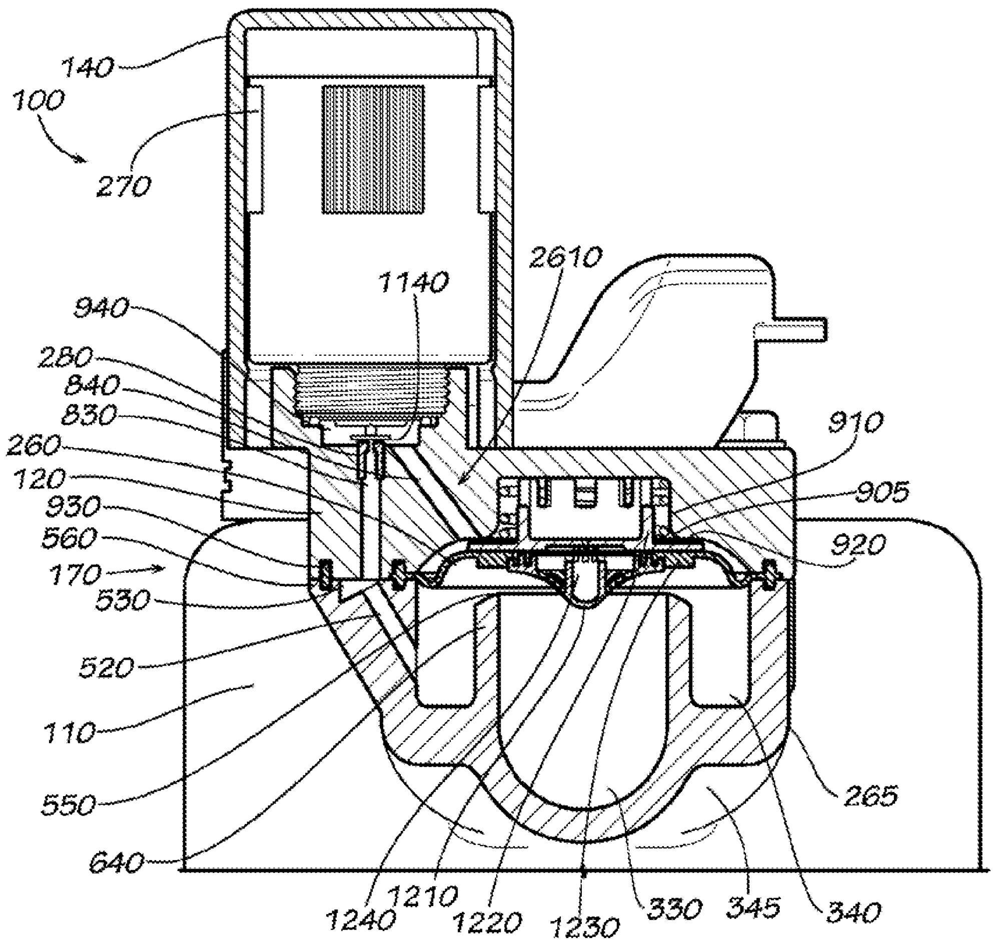
140
100
270
2610
1140
940
280
840
830
260
120
930
560
170
530
520
110
550
640
910
905
920
265
1240
1210
1220
1230
330
345
340

FIG. 27

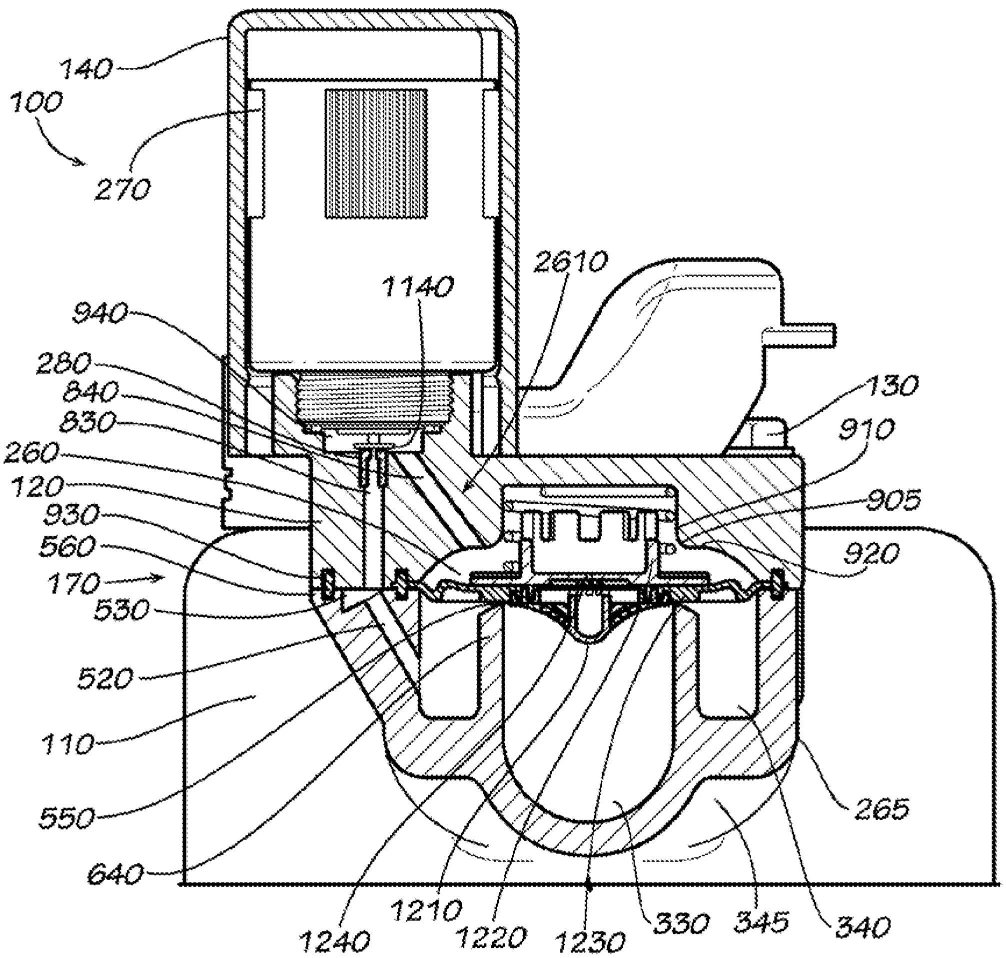
140
100
270
2610
1140
940
280
840
830
260
120
930
560
170
530
520
110
550
640
130
910
905
920
265
1240
1210
1220
1230
330
345
340

FIG. 28

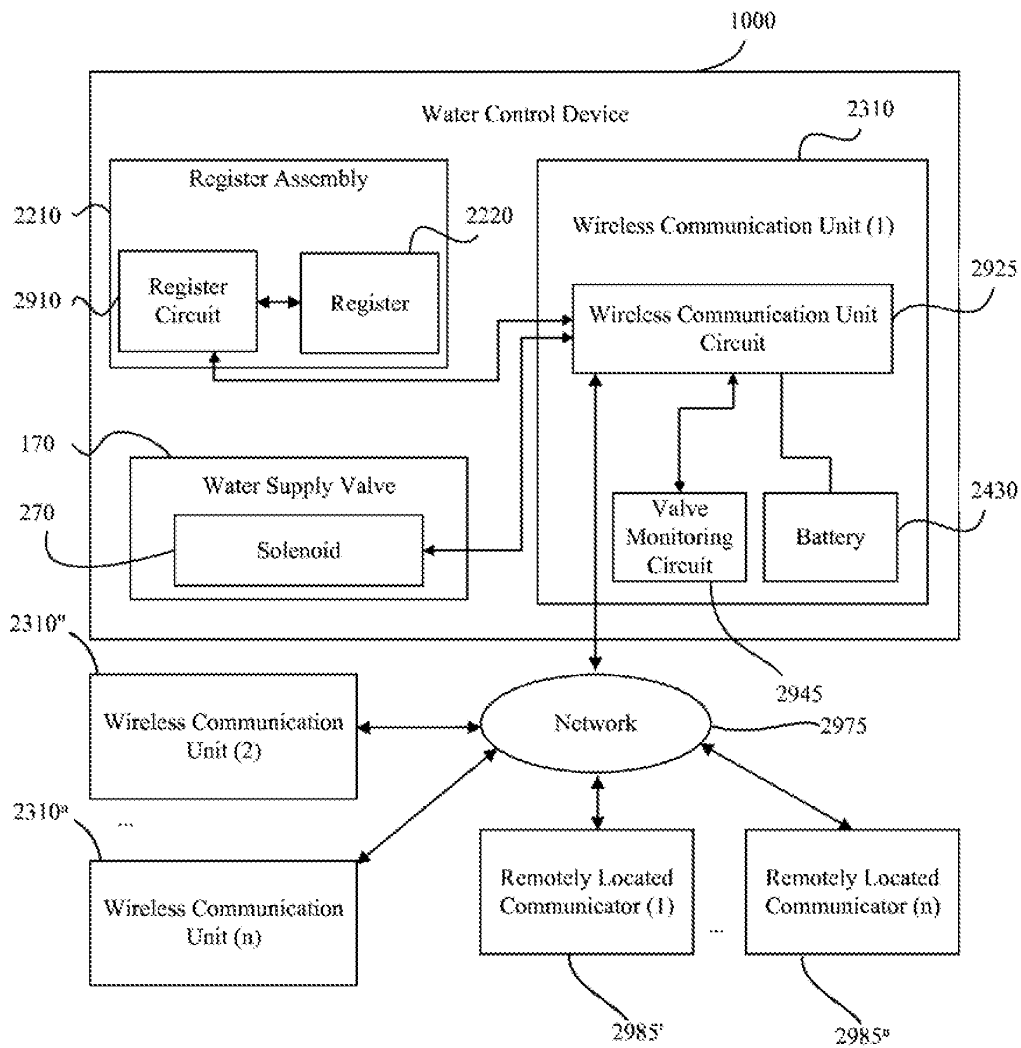
1000
Water Control Device
2310
Register Assembly
2210
2220
Wireless Communication Unit (1)
2925
2910
Register Circuit
Register
Wireless Communication Unit Circuit
170
Water Supply Valve
2430
270
Solenoid
Valve Monitoring Circuit
Battery
2310''
2945
Wireless Communication Unit (2)
Network
2975
2310ⁿ
...
Wireless Communication Unit (n)
Remotely Located Communicator (1)
...
Remotely Located Communicator (n)
2985'
2985ⁿ

FIG. 29

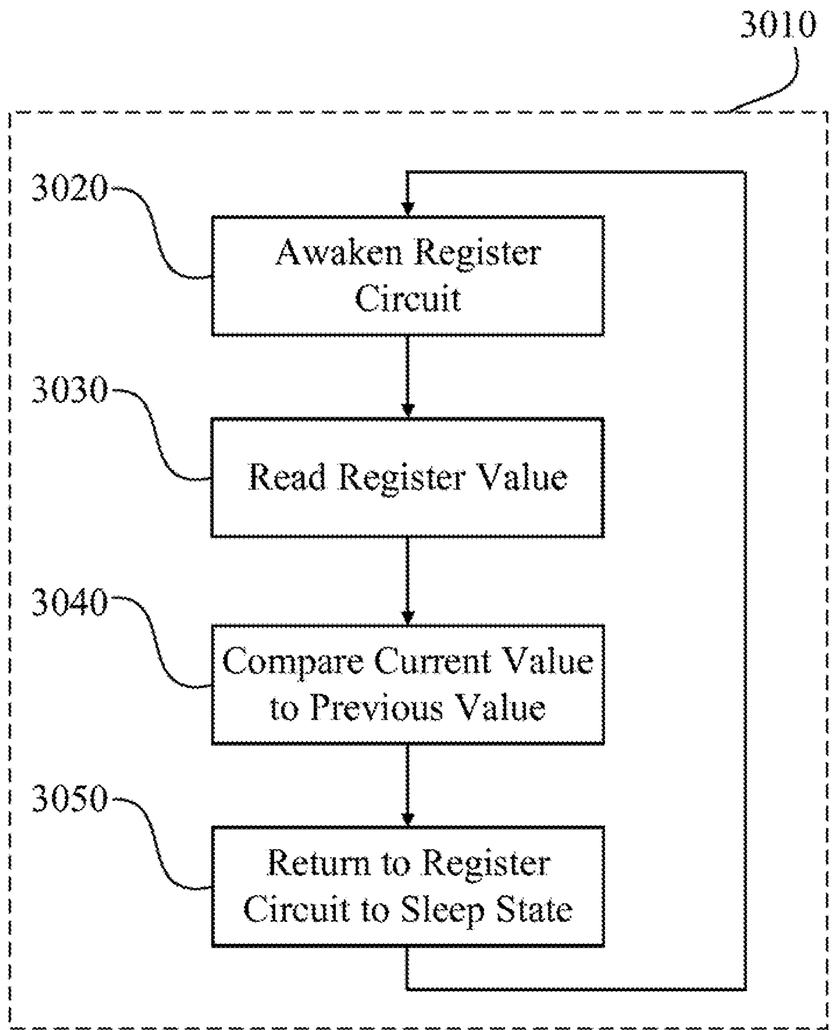
3010
3020
Awaken Register Circuit
3030
Read Register Value
3040
Compare Current Value to Previous Value
3050
Return to Register Circuit to Sleep State

FIG. 30

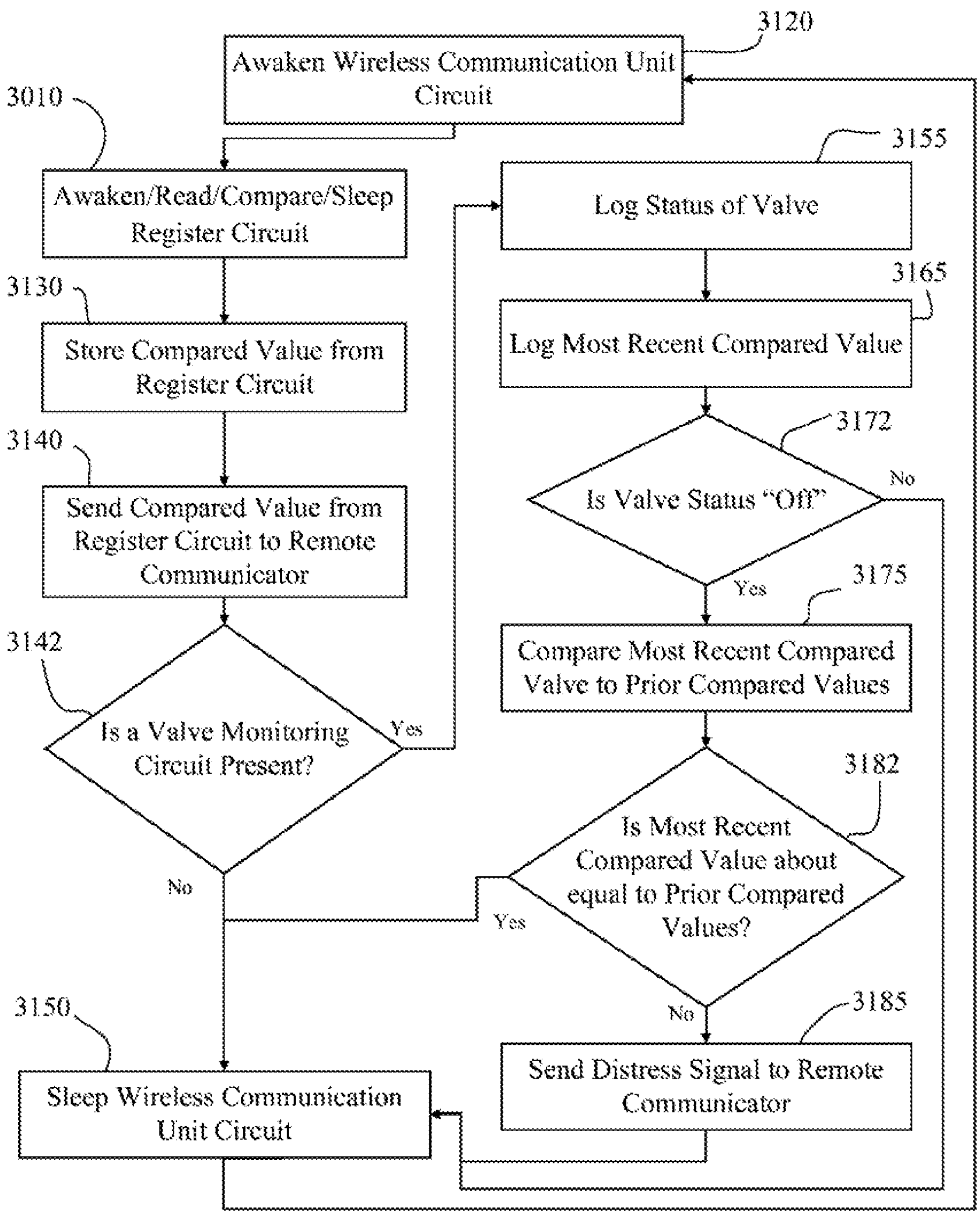
3120
Awaken Wireless Communication Unit Circuit
3010
Awaken/Read/Compare/Sleep Register Circuit
3130
Store Compared Value from Register Circuit
3140
Send Compared Value from Register Circuit to Remote Communicator
3142
Is a Valve Monitoring Circuit Present?
Yes
No
3155
Log Status of Valve
3165
Log Most Recent Compared Value
3172
Is Valve Status "Off"
No
Yes
3175
Compare Most Recent Compared Valve to Prior Compared Values
3182
Is Most Recent Compared Value about equal to Prior Compared Values?
Yes
No
3185
Send Distress Signal to Remote Communicator
3150
Sleep Wireless Communication Unit Circuit

FIG. 31

VALVE METER ASSEMBLY AND METHOD

TECHNICAL FIELD

The present disclosure relates to water control and metering, specifically water flow monitoring and control.

BACKGROUND

Water is typically supplied by a water provider which is usually a municipality. Water providers deliver water to businesses and individuals via piping systems. A piping system could be an upstream piping system, including a system to carry water from a water provider to a meter, or a downstream piping system, including a system to carry water from a meter to a user terminal. Because water providers typically sell water by unit volume, there exists a need to measure water flow to a user terminal to generate a water bill. As used herein, user terminal may include an individual residence, a place of business or any other point of termination of the water flow. Typically, a water meter will be placed in the water supply line between the water source and the user terminal to measure all water flowing to that user terminal. Meters are read and checked against prior readings to determine the total flow of water to the user terminal.

When a water user has not provided payment for water already used, it is typical in the industry for a water provider to discontinue supplying water to the user terminal associated with the water user. Typically, a water provider will install a manual water supply valve in the supply line in anticipation of the need to discontinue water supply. Although the valve may be operated rarely, a manual valve is standard equipment for water providers.

Typically, water meters are read manually by water meter readers who are employees or contractors of the water providers. Additionally, it is also typical that water supply valves are manually operated by employees or contractors of the water providers. These manual operations associated with providing water represent a significant cost of a typical water provider. With the advent of wireless technology, water providers have sought methods and systems for remote reading of water meters and/or remote control of water supply valves.

Mesh networks for remote reading of water meters exist currently. Systems for remotely controlling the water supply valve exist currently. However, these systems are often cumbersome to implement, requiring excavation and replacement of water supply lines to implement a remotely controlled water supply valve. Electronic remote control of valves and reading of meters has been implemented through wired connections. While wireless systems for controlling valves or for reading meters do exist, the cast ferrous materials used to make most water meter housings can interfere with wireless signals, so the wireless equipment often cannot be placed in close proximity to typical meter housings. Moreover, a remotely controlled valve typically involves a separate system and apparatus from a remotely readable water meter. Systems that integrate a shutoff valve and water meter together are often too large to be installed without excavation of the water supply lines and are typically difficult to service if parts fail. Some systems designed to fit into the standard water meter lay-length of a water meter provide inordinate head loss through the system and provide only remote control of the valve and no ability to read the meter remotely. Moreover, wireless water supply valves typically have relatively short operative lives because their operation requires large amounts of energy.

DESCRIPTION OF THE FIGURES

The features and components of the following figures are illustrated to emphasize the general principles of the present disclosure and are not necessarily drawn to scale. Corresponding features and components throughout the figures may be designated by matching reference characters for the sake of consistency and clarity.

FIG. **1** is a perspective view of a valve meter device in accordance with one embodiment of the disclosure.

FIG. **2** is an exploded view of the valve meter device of FIG. **1**.

FIG. **3** is a side view of the device housing of the valve meter device of FIG. **1**.

FIG. **4** is a bottom view of the device housing of FIG. **3**.

FIG. **5** is a top view of the device housing of FIG. **3**.

FIG. **6** is a sectional view of the device housing of FIG. **5** taken in a plane indicated by line **6** in FIG. **5**.

FIG. **7** is a sectional view of the valve portion of the device housing of FIG. **5** taken in a plane indicated by line **7** in FIG. **5**.

FIG. **8** is a top view of the valve cover of the valve meter device of FIG. **1**.

FIG. **9** is sectional view of the valve cover of FIG. **8** taken in a plane indicated by line **9** in FIG. **8**.

FIG. **10** is a bottom view of the valve cover of FIG. **8**.

FIG. **11** is a side view of the solenoid of the valve meter device of FIG. **1**.

FIG. **12** is an exploded view of the diaphragm assembly of the valve meter device of FIG. **1**.

FIG. **13** is a top view of the diaphragm of the diaphragm assembly of FIG. **12**.

FIG. **14** is a sectional view of the diaphragm of FIG. **13** taken in a plane indicated by line **14** in FIG. **13**.

FIG. **15** is a top view of the valve cone of the diaphragm assembly of FIG. **12**.

FIG. **16** is a sectional view of the valve cone of FIG. **15** taken in a plane indicated by line **16** in FIG. **15**.

FIG. **17** is a bottom view of the backing plate of the diaphragm assembly of FIG. **12**.

FIG. **18** is a top view of the backing plate of FIG. **17**.

FIG. **19** is a sectional view of the backing plate of FIG. **17** taken in a plane indicated by line **19** in FIG. **18**.

FIG. **20** is a sectional view of the diaphragm assembly of the valve meter device of FIG. **1** taken in a plane proceeding over the diameter of the assembly.

FIG. **21** is a sectional view of the water meter of the valve meter device of FIG. **1** taken in a plane proceeding through the center axis of the flow path of water through the valve meter device FIG. **1**.

FIG. **22** is a side view of a register assembly included in accord with one embodiment of the valve meter device of FIG. **1**.

FIG. **23** is a perspective view of a valve meter assembly including the valve meter device of FIG. **1**, the register assembly of FIG. **22**, and a wireless communication unit included in accord with one embodiment of the disclosure.

FIG. **24** is an exploded view of the wireless communication unit of the valve meter device of FIG. **23**.

FIG. **25** is a sectional view of the valve meter device of FIG. **1** taken in a plane proceeding through the center axis of the flow path of water through the valve meter device.

FIG. **26** is a sectional view of the valve meter device of FIG. **1** taken in a plane indicated by line **26** in FIG. **25** wherein the valve meter device is in the "open" state with the water supply valve and solenoid "open."

FIG. **27** is the sectional view FIG. **26** wherein the valve meter device is in a dynamic state with the solenoid in the "closed" position and the water supply valve in the "open" state.

FIG. **28** is the sectional view FIG. **26** wherein the valve meter device is in the "closed" state with the water supply valve and solenoid "closed."

FIG. **29** is a circuit diagram of the valve meter assembly of FIG. **23**.

FIG. **30** is a flow diagram illustrating functioning of a register circuit of the valve meter assembly of FIG. **23**.

FIG. **31** is a flow diagram illustrating functioning of a wireless communication unit circuit, including a valve monitoring circuit, of the valve meter assembly of FIG. **23**.

DETAILED DESCRIPTION

Disclosed is a valve meter device, a valve meter assembly, and a method for remotely reading a water meter and controlling a water supply valve. The valve meter device includes a water supply valve and a water meter dimensioned together to fit within a standard water meter lay-length with reduced head loss. The valve meter device includes a water meter and at least part of a water supply valve together in one housing.

In one embodiment, the valve meter device is capable of communicating with a remotely located communicator. The remotely located communicator may receive signals from the valve meter device, send signals to the valve meter device, or both send signals to and receive signals from the valve meter device.

FIG. **1** is a perspective view of one embodiment of a valve meter device **100**. The valve meter device **100** includes a device housing **110**. The device housing **110** forms the main body through which water will flow. A valve cover **120** is attached to the device housing **110** using valve cover screws **130***a,b* (**130***c,d* not shown). A solenoid tamper cover **140** is attached to the top of the valve cover **120**. A bottom plate **150** is attached to the device housing **110** with bottom plate screws **160***a,b* (**160***c,d* not shown). In this disclosure, references to "top", "bottom", "down", "up", "downward", or "upward" refer to the valve meter device **100** as oriented in FIG. **1**. Various features of the valve meter device **100** may be altered, reoriented, reconfigured, replaced, rotated, or moved in alternative embodiments. No one configuration is intended to be limiting on this disclosure.

The valve meter device **100** includes a water supply valve **170** and a water meter **210** (shown in FIG. **2**). The water supply valve **170** is partially integrated with the device housing **110** and includes the valve cover **120** screwed onto the device housing **110** to enclose some components of the water supply valve **170** inside a cavity defined between the valve cover **120** and the device housing **110**. Although the current embodiment includes a partially integrated construction with a separately attached cover, alternative embodiments are included in this disclosure and may include a plastic welded assembly, separate valve and device housing subassemblies connected together via plastic welding, or separate valve and device housing subassemblies connected together mechanically, among others.

FIG. **2** is an exploded view of the valve meter device **100**. The device housing **110** includes a meter portion **264** and a valve portion **265**. The device housing **110** and bottom plate **150** are configured to enclose a water meter **210** and a strainer retainer **220** in the meter portion **264**. The bottom plate **150** is attached to the device housing **110** with bottom plate screws **160***a-d*. A meter gasket **230** is inserted between the bottom plate **150** and the device housing **110**. A bottom plastic liner **240** is inserted between the bottom plate **150** and the device housing **110**. The meter **210** in the current embodiment is a nutating disc displacement flow meter. Other meter types may be used with the valve meter device **100**. The meter **210** has a metering inlet **212** and a metering outlet **213** located proximate to each other. The metering outlet **213** is surrounded by a metering outlet rubber gasket **215**.

The valve cover **120** and the valve portion **265** of the device housing **110** enclose a spring **250** and a diaphragm assembly **260**. The solenoid tamper cover **140** encloses a solenoid **270** and a valve orifice cylinder **280** onto the valve cover **120**. The valve orifice cylinder **280** is a steel cylinder with a cylindrical bore extending its entire top to bottom length. The solenoid **270** is attached to the valve cover **120**. The valve orifice cylinder **280** sits in a media channel **520** (seen in FIG. **5**) and interacts with the solenoid **270** to change water flow through the media channel **520** when the solenoid **270** is placed in an "open" or a "closed" position. The valve orifice cylinder **280** has a cylindrical shape in the current embodiment, but the valve orifice cylinder **280** may be various shapes. A solenoid tamper cover screw **290** provides the attachment of the solenoid tamper cover **140** to the valve cover **120**.

In alternative embodiments, the spring **250** may not be required for valve operation. Other parts of the water supply valve **170**, including the solenoid tamper cover **140**, may not be necessary in alternative embodiments of the valve meter device **100**. The valve cover **120** and the valve portion **265** of the device housing **110** are screwed together to enclose the optional spring **250** and the diaphragm assembly **260** using valve cover screws **130***a,b,c,d*.

As illustrated in FIG. **3**, the device housing **110** has an inlet **310** and an outlet **320**. Water flows through the device housing **110** by flowing into the inlet **310** and the out of the outlet **320**. The inlet **310** includes an inlet end **616** (shown in FIG. **6**), an inlet threaded portion **315**, an inlet neck **622** (shown in FIG. **6**), and an inlet opening **612** (shown in FIG. **6**). The outlet **320** includes an outlet end **618** (shown in FIG. **6**), an outlet threaded portion **325**, an outlet neck **624** (shown in FIG. **6**), and an outlet opening **614** (shown in FIG. **6**). The inlet threaded portion **315** and the outlet threaded portion **325** allow for attachment to a piping system, including an upstream piping system or a downstream piping system or both. The inlet opening **612** and outlet opening **614** are connected by a flow channel **691** (shown in FIG. **6**) that extends from the inlet end **616** to the outlet end **618** and passes through the inside of the device housing **110**. Water flows into the inlet **310** from a provider or water source and out of the outlet **320** to a home, office building, or other user terminal. Both the inlet **310** and the outlet **320** are attachable to the piping system via the inlet threaded portion **315** and outlet threaded portion **325**, respectively, with a coupling nut (not shown).

FIG. **3** illustrates the valve portion **265** and meter portion **264** of the device housing **110**. To reduce head loss, the water supply valve **170** (including the valve portion **265**) and the meter **210** (placed in the meter portion **264**) are oriented such that at least a portion of each of the water supply valve **170** and the meter **210** touch an imaginary line drawn between the inlet **310** and the outlet **320** thereby forming an "in line" configuration. The "in line" configuration is not achieved by staggering water supply valve **170** and the meter **210**, as such staggering may result in unacceptable head loss. In the current embodiment, the maximum acceptable head loss is 6 psi at 20 gallons per minute, although other embodiments may include other limits. To avoid staggering of the water supply valve **170** and the meter **210**, the "in line" configuration is achieved by using suitably sized components (such as valves

adequately sized for rated pressure in the system and piping diameter not larger than necessary for required flow), reducing wall thicknesses of the housing, shortening features including the inlet **310** and outlet **320**, and using water supply valve **170** with a coaxial valve inlet portion **330** and valve outlet portion **340**. However, the "in line" configuration does not indicate that components of the valve meter device **100**, including the meter **210** and water supply valve **170**, are located along the same horizontal plane. Should components or features, including the water supply valve **170** and the meter **210**, of the valve meter device **100** be staggered such that the components are not along the same horizontal plane, such a configuration typically is arranged to accommodate other requirements, such as an uneven piping system or multiple inlet or outlet configurations, and not to address the requirement of fitting the valve meter device **100** into a standard water meter lay-length.

Although the current embodiment has the valve portion **265** proximate the inlet **310** and the meter portion **264** proximate the outlet **320**, the placement of these or other portions of the device housing **110** or the valve meter device **100** may be rearranged. As illustrated in FIG. **3** (as well as FIG. **6**), the valve portion **265** includes a valve inlet portion **330** and a valve outlet portion **340** which overlap each other. Part of the valve inlet portion **330** is coaxial with part of the valve outlet portion **340** in the current embodiment. The valve outlet portion **340** has a slanted bottom portion **345** that is slanted from the inlet side of the water supply valve **170** to the outlet side of the water supply valve **170** to encourage water flow to the valve outlet portion **340**. The slant helps reduce head loss by promoting consistent flow. A meter inlet portion **350** is attached to the valve outlet portion **340**. The meter inlet portion **350** is also attached to the meter portion **264**. A meter outlet portion **360** exists between the meter portion **264** and the outlet **320**.

The inlet **310** and outlet **320** are portions of the device housing **110** in the current embodiment. In alternative embodiments, the inlet **310** and outlet **320** may be separate pieces connected to the device housing **110**. The device housing **110** is dimensioned so that it can fit within a standard water meter lay-length. The standard water meter lay-length of a standard water meter is designated in various industry standards documents, including the American Water Works Association (AWWA). The AWWA C700 standard requires 7.5 inches standard water meter lay-length for meters with ⅝-inch piping diameter. Other AWWA standards, such as C708 and C710, also specify the same laying lengths for meters of like sizes.

A top portion **380** of the meter portion **264** includes a register connection interface **385**. The register connection interface **385** includes several teeth **390***a,b,c,d* (**390***e,f* shown in FIG. **5**) designed to attach a separate register assembly **2210** (shown in FIG. **22**) to the top portion **380**. A bottom portion **395** of the meter portion **264** is configured to accept the bottom plate **150** attaching to the device housing **110**. The bottom portion **395** and the bottom plate **150** may be connected via a threaded interaction, a screw and bore attachment, or a welded attachment, among others. For maximum wireless communication capabilities, the device housing **110** may be composed of brass, bronze, plastic, aluminum, or other non-ferrous material. The device housing **110** may also be made of ferrous materials based on the specific application.

FIG. **4** is a bottom view of the device housing **110**, including the inlet **310**, the valve inlet portion **330**, the valve portion **265**, the valve outlet portion **340**, the meter inlet portion **350**, the meter portion **264**, the meter outlet portion **360**, and the outlet **320**.

The valve inlet portion **330** extends from the inlet neck **622** (not shown) to the valve outlet portion **340**. The valve inlet portion **330** terminates inside the valve outlet portion **340** on a concentric profile, as illustrated in later figures.

The meter portion **264** of the device housing **110** is sized to define a meter cavity **450**. Although the current embodiment of the meter portion **264** is cylindrical, the meter portion **264** need not be a specific shape, but need only accommodate the meter **210**. Wall **460** of the meter portion **264** is sized to accommodate the water pressure of the piping system. The meter portion **264** also includes four threaded bottom plate attachment bores **470***a,b,c,d* for attachment of the bottom plate **150** with the bottom plate screws **160***a,b,c,d* (as seen in FIG. **2**).

Inside the meter cavity **450** of the device housing **110**, a meter outlet standoff **480** is shaped to accommodate the metering outlet rubber gasket **215** of the meter **210** to seal the connection (as seen in FIG. **2**). Meter cavity standoffs **490***a,b* are also provided in the meter cavity to prevent the meter from jostling under the flow of water and to retain the strainer retainer **220** in position between the meter inlet portion **350** and the meter **210**.

Turning to FIG. **5**, the valve portion **265** includes four threaded valve cover bores **510***a,b,c,d* for attachment of the valve cover **120** to the valve portion **265** of the device housing **110**. In the current embodiment, the valve cover **120** is attached using four valve cover screws **130***a,b,c,d* (shown in FIGS. **1** and **2**) that attach through the valve cover **120** to each valve cover bore **510***a,b,c,d*. As noted above, the attachment could also be achieved using welding, which would obviate any need for valve cover bores **510***a,b,c,d* or valve cover screws **130***a,b,c,d*. The valve portion **265** of the device housing **110** also includes a media channel **520** which is a bore that extends from the valve outlet portion **340** to a media channel relief **530** in the device housing **110**. A diaphragm ring recess **560** lines the top of the valve portion **265** and the media channel relief **530**. The beveled edge **550** seals the water supply valve **170** in operation.

As illustrated in the embodiment in FIG. **6**, the valve inlet portion **330** communicates with the inlet neck **622** of the device housing **110**. In one embodiment, the valve inlet portion **330** has an inner diameter sized larger than the inner diameter of the inlet neck **622** to reduce head loss through the water supply valve **170**. The valve outlet portion **340** communicates with the meter inlet portion **350** of the device housing **110**. The valve portion **265** includes the valve inlet portion **330** and the valve outlet portion **340** and all related transitional portions. In the current embodiment, the valve portion **265** is integrated with the device housing **110**. However, alternative embodiments are contemplated herein, including separate housing units for the valve portion **265** and the meter portion **264** which are mechanically joined.

As illustrated in FIG. **6**, a linear distance **665** exists between inlet end **616** and outlet end **618** of the device housing **110**. In the current embodiment, linear distance **665** is 7.5 inches to comply with American Water Works Association standard AWWA C700. The flow channel **691** in the device housing **110** extends from the inlet end **616** to the outlet end **618**.

The valve inlet portion **330** includes a horizontal portion **610** and a vertical portion **620**. In the current embodiment, the horizontal portion **610** and vertical portion **620** form a right angle, although other angular configurations are acceptable and are contemplated by this disclosure. The horizontal por-

tion 610 extends from the inlet 310 to a location proximate to the center of the water supply valve 170. At this location, the horizontal portion 610 merges into the vertical portion 620. The vertical portion 620 extends vertically inside the valve outlet portion 340. The valve outlet portion 340 of the device housing 110 includes the slanted bottom portion 345. The slanted bottom portion 345 of the valve outlet portion 340 directs water to the meter inlet portion 350 of the device housing 110. It should be noted that the configuration of inlets and outlets may be reversed in other embodiments. For example, the valve inlet portion 330 may be positioned on the outside of the valve outlet portion 340 in an alternative embodiment, whereas the valve outlet portion 340 is positioned on the outside of the valve inlet portion 330 in the current embodiment. A top edge portion 640 of the valve inlet portion 330 includes the beveled edge 550. The valve portion 265 of the device housing 110 also includes the diaphragm ring recess 560. A valve transition portion 670 allows the merger of the valve inlet portion 330 to the valve outlet portion 340.

As illustrated in FIG. 6, the device housing 110 has an outer surface 680 and an inner surface 690. At the water supply valve 170, the valve inlet portion 330 transitions to the valve outlet portion 340 having the valve cover 120 (see FIG. 25) placed over the valve transition portion 670. The meter cavity 450 and the bottom plate 150 enclose the meter 210 (see FIG. 25). The inner surface 690 defines the flow channel 691 in the device housing 110. The water supply valve 170 is also in sealable communication with the flow channel 691.

In one embodiment of the valve meter device 100, the meter inlet portion 350 is substantially rectangular to reduce head loss as water flows out of the valve outlet portion 340, through the meter inlet portion 350, and into the meter cavity 450. Reduced head loss is achieved because the rectangular cross-section provides a larger cross-section through which water may flow than a rounded cross-section.

The sectional view of device housing 110 shown in FIG. 7 illustrates the placement of the media channel 520 that exists between the media channel relief 530 and the valve outlet portion 340.

FIG. 8 is a top view of the valve cover 120. Four screw bores 810*a,b,c,d* are located at the corners of the valve cover 120. A solenoid attachment portion 820 is a cylindrical boss including a threaded solenoid attachment sink 825 on the inside of the boss. A valve cover media channel 830 is aligned with the center of the solenoid attachment sink 825. The valve cover media channel 830 passes through the valve cover 120 and aligns with the media channel 520 when the valve meter device 100 is assembled. A valve cavity media channel 840 is also shown in the solenoid attachment portion 820. The valve cover 120 in the current view of the current embodiment also includes casting recesses 850 and a serial plate 860. A threaded solenoid cover screw bore 870 is located in a protrusion 875. Although the valve cover 120 is rectangular in shape, one side of the valve cover 120 includes a curve 880. The curve 880 is included to provide clearance for the register assembly 2210 to be placed on the valve meter device 100. A countercurve protrusion 890 is proximate the bottom of the curve 880 to accommodate the diaphragm ring recess 560.

As illustrated in the section view of the valve cover 120 in FIG. 9, the valve cover 120 includes a valve cavity 905. The valve cavity 905 and the valve portion 265 enclose components of the diaphragm assembly 260. The valve cavity 905 and the valve portion 265 may also enclose the spring 250. The valve cavity 905 also includes a valve recess 910 and a valve bonnet 920, which together are shaped to accept the diaphragm assembly 260 and the spring 250. The valve cover 120 also includes a diaphragm ring recess 930 shaped to align with the diaphragm ring recess 560.

The solenoid attachment portion 820 is dimensioned to define a solenoid chamber 940 between the solenoid 270 and the valve cover 120 when the solenoid 270 is attached to the valve cover 120. The valve cavity media channel 840 connects the valve cavity 905 with the solenoid chamber 940. Although the valve cavity media channel 840 is shown to connect with the valve bonnet 920 in the current embodiment, the valve cavity media channel 840 may connect to any portion of the valve cavity 905, including the valve recess 910. Because the valve cover media channel 830 is aligned with the center of the solenoid attachment portion 820, the valve cover media channel 830 connects to the solenoid chamber 940. A valve orifice recess 950 is also seen in the valve cover media channel 830 to accommodate the valve orifice cylinder 280. When the valve meter device 100 is assembled, the valve orifice cylinder 280 is placed into the valve orifice recess 950. FIG. 10 is a bottom view of the valve cover 120.

FIG. 11 shows the solenoid 270 of the valve meter device 100. The solenoid 270 includes a solenoid body 1110, a threaded attachment portion 1120, and a plunger 1130. The plunger 1130 includes a shaft portion 1135 and an interface portion 1140. Although the solenoid in the current embodiment is designed to be attached via threaded interaction, other attachment means are contemplated, including glue, welding, and screw bore attachments among others. The solenoid tamper cover 140 covers the solenoid 270 when the valve meter device 100 is assembled. When the valve meter device 100 is assembled, the interface portion 1140 of the plunger 1130 may contact and seal the valve orifice cylinder 280, as will be described later.

FIG. 12 is an exploded view of the diaphragm assembly 260. The diaphragm assembly 260 includes a valve cone 1210, a backing plate 1220, a diaphragm 1230, and a strainer 1240. The strainer 1240 is a disc-shaped piece of straining material that traps impurities as water flows through the component. The strainer may be removed in alternative embodiments.

The valve cone 1210 is a conical-shaped plastic piece placed on the bottom side of the diaphragm 1230. The valve cone 1210 is plastic because it is plastic welded in the assembly of the current embodiment. However, other joining interfaces which would invoke other possible material choices for the valve cone 1210 are contemplated by this disclosure. The valve cone 1210 is cone-shaped on an outer, downward-facing surface 1250. The downward facing surface 1250 in the current embodiment is curved. However, the downward facing surface 1250 may be straight in alternative embodiments. The downward facing surface 1250 includes multiple water leak passthroughs 1260.

FIG. 13 is a top view of the diaphragm 1230. The diaphragm 1230 may be made of a flexible material. In the current embodiment the diaphragm 1230 is made of rubber. The flexibility of the diaphragm 1230 allows travel of the central portions (1410,1420,1430,1440,1450, described later) without movement of the edge portions (1310,1320, described later) as achieved by multiple wrinkled or corrugated portions (1410,1420,1430, described later) that may be stretched to achieve a desired throw. The diaphragm 1230 includes a gasketing diaphragm ring 1310. A media channel seal ring 1320 is a looping portion of the diaphragm 1230 extending radially outward. The media channel seal ring 1320 is configured to seal the interface between the valve cover media channel 830 and the media channel 520.

FIG. 14 is a sectional view of the diaphragm 1230. The gasketing diaphragm ring 1310 is on the outer edge of the

diaphragm **1230**. Radially inward adjacent to the gasketing diaphragm ring **1310** is an attached outer flat portion **1410**. Radially inward adjacent to the outer flat portion **1410** is a forward throw corrugation **1420**. As shown, the forward throw corrugation **1420** is a rounded, semi-circular portion. Radially inward adjacent to the forward throw corrugation **1420** is a rearward throw corrugation **1430**. The rearward throw corrugation **1430** is a rounded, quarter-circular portion. Radially inset to the rearward throw corrugation **1430** is an inner flat portion **1440**. The inner flat portion **1440** defines a valve cone bore **1450**. The inner flat portion **1440** defines a valve cone groove **1460**. The valve cone groove **1460** interfaces with the valve cone **1210**. Further inset radially from the valve cone groove **1460** is a valve cone retainer **1470**. The valve cone retainer **1470** interfaces with the inside of the valve cone **1210**. As stated above, the media channel seal ring **1320** is not concentric because it extends radially outward. Although all components of the diaphragm are connected and integrated in the current embodiment, alternative embodiments may include separate pieces that may or may not be joined together. For example, the gasketing diaphragm ring **1310** may be a separate component in alternative embodiments.

FIG. **15** illustrates a top view of the valve cone **1210**. The valve cone **1210** has three main circular channel portion cutouts. A diaphragm retention channel **1520** is bounded by a shoulder **1530** that interfaces with the valve cone groove **1460**. Inset radially from the diaphragm retention channel **1520**, a weld channel **1540** provides a welding interface with the backing plate **1220**. Inset radially from the weld channel **1540**, a water leak channel **1550** includes features (described below) that communicate water from the valve inlet portion **330** to the valve cavity **905**. On the inner surface **1555** of the water leak channel **1550**, eighteen water subchannels **1560** are spaced twenty degrees apart circumferentially about the center axis of the valve cone **1210**. The number of subchannels and the configuration of pathways may change in alternative embodiments. In the center of the valve cone **1210** is a cylindrical standoff **1570**. The cylindrical standoff **1570** has multiple fins **1580** located at its top.

FIG. **16** shows a sectional view of the valve cone **1210**. The surface profile of the inner surface **1555** is complementary to the surface profile of the downward facing surface **1250**, providing a consistent wall thickness of the valve cone **1210** in that region. The depth of the water subchannels **1560** varies across each channel. A "stair step" depth pattern defines four water leak passthroughs **1260** per water subchannel **1560**. In total, seventy-two water leak passthroughs **1260** are assembled in groups of four spaced twenty degrees apart around the downward facing surface **1250**. The specific configuration of water leak passthroughs **1260** may be varied in alternative embodiments.

FIG. **17** shows a bottom view of the backing plate **1220**. The backing plate **1220** includes a downward facing surface **1710** and an upward facing surface **1810** (shown in FIG. **18**). The downward facing surface **1710** has a cylindrical weld portion **1720** where the backing plate **1220** will weld to the valve cone **1210**. Ten flow path portions **1730** are wedge-shaped cutouts in the downward facing surface. The specific number or shape of flow path portions may vary in alternative embodiments. The wedge-shaped cutouts **1730** prevent the strainer **1240** from becoming pushed flush against the backing plate **1220**. This allows water to flow through the diaphragm assembly **260**. A water leak hole **1740** is in the center of the backing plate **1220** to allow the flow of water through the backing plate **1220**.

FIG. **18** is a top view of the backing plate **1220**. The upward-facing surface **1810** includes a cylindrical spring portion **1820** sized to accommodate the optional spring **250** placed around it. The top of the cylindrical spring portion **1820** includes a fence **1830**. The fence **1830** operates to preserve water flow above the cylindrical spring portion **1820** and below the valve cover **120**. This space allows water to flow through the cylindrical spring portion **1820** into the valve bonnet **920**. The upward-facing surface **1810** includes several wedge-shaped standoffs **1840**. The wedge-shaped standoffs **1840** prevent the backing plate **1220** from becoming affixed by vacuum to the valve cover **120** in the valve recess **910**.

FIG. **19** is a sectional view of the backing plate **1220**. The cylindrical weld portion **1720** includes a weld edge **1910** that is sharpened to provide a welding interface between the backing plate **1220** and the valve cone **1210**.

FIG. **20** displays a sectional view of the diaphragm assembly **260**. The diaphragm assembly **260** includes the valve cone **1210** having its downward facing surface **1250** facing down and its upward facing surface **1510** facing up. The diaphragm **1230** is placed onto the valve cone **1210** with the diaphragm retention channel **1520** interfacing with the valve cone retainer **1470**. The shoulder **1530** is interfacing with the valve cone groove **1460**. The strainer **1240** is circular with perforations to allow water to flow through while trapping impurities. The strainer **1240** is centered on the valve cone **1210**. The backing plate **1220** is placed over the strainer **1240** and onto the valve cone **1210** and diaphragm **1230**. The cylindrical weld portion **1720** extends into the weld channel **1540** where it is welded with the valve cone **1210**. When the backing plate **1220** is welded to the valve cone **1210**, the diaphragm assembly **260** is complete with the strainer **1240** trapped inside the valve cone **1210** and the backing plate **1220** weld and the diaphragm **1230** trapped between the valve cone **1210** and the backing plate **1220**. Welding provides a watertight seal between the valve cone **1210** and the backing plate **1220**.

FIG. **21** displays the meter **210**. The meter **210** is a standard nutating disc displacement flow meter. Other meters may also be used in lieu of the nutating disc displacement flow meter. Internal to the meter is a nutating disc **2110** that interfaces with an output register interaction shaft **2120**. The nutating disc **2110** includes a disc pin **2115** which engages the output register interaction shaft **2120**. In operation, the nutating disc **2110** and disc pin **2115** wobble about a fixed point in the meter to drive the output register interaction shaft **2120**. The output register interaction shaft **2120** is attached to a meter magnet **2130**. The meter magnet **2130** has a four-pole arrangement that coordinates with a register **2220** (shown in FIG. **22**) such that when the meter magnet **2130** turns the register **2220** logs the motion and provides a readout of water usage. It should be noted that any descriptions related to the functioning of the meter **210** and its interaction with any register **2220** are related to one embodiment of the invention, and other types of meters and registers may be used with the current and alternative embodiments of the disclosed device.

As seen in FIG. **22**, the register assembly **2210** includes the register **2220**, a register cover **2230**, a register bracket **2240**, and a housing attachment ring **2250**. The register **2220** is a magnetic interface register that interfaces with the meter **210** via a magnetic pole arrangement. The register **2220** has internal components and is externally made of glass or clear plastic having an external shape that is cylindrical. The housing attachment ring **2250** is a ring sized to encircle the register **2220**. The housing attachment ring **2250** has clamping teeth (not shown) that interface with the teeth **390***a,b,c,d,e,f* of the device housing **110** to clamp the register assembly **2210** onto

the device housing **110**. The housing attachment ring **2250** is placed onto the register **2220** by inserting it over the top of the register **2220** and sliding it to the bottom of the register **2220**. Other means of attaching the register **2220** and register assembly **2210** to the device housing **110** are intended to be included within this and alternative embodiments.

In a valve meter assembly **1000**, the register assembly **2210** is connected to the top **380** of the device housing **110**, as shown in FIG. **23**. In an embodiment of the valve meter assembly **1000**, a communication device is included with the valve meter assembly **1000**. The communication device in some embodiments may be a wireless communication unit **2310**. In the current embodiment, the wireless communication unit **2310** is part of a mesh network where the mesh network includes the remotely located communicator. The remotely located communicator may be operated by a municipality, a technician, a service provider, or another entity. The remotely located communicator may be any communication device or system including a computer, a server, a gateway, another valve meter assembly, a handheld device, a mesh network, or any other device or system capable of communicating with the wireless communication unit **2310**. A bracket **2365** is provided for attachment of the wireless communication unit **2310**. In the valve meter assembly **1000**, the bracket **2365** is integrated with register bracket **2240** as an arm of the register bracket **2240**, although the bracket **2365** may be connected to, integrated with, or attached to other features of the valve meter assembly **1000**.

The wireless communication unit **2310** is shown in exploded view in FIG. **24**. The wireless communication unit **2310** has a two-part plastic cover **2320** having a top **2320***a* and a bottom **2320***b*. The plastic cover **2320***a,b* includes a bracket attachment portion **2410** for attachment to the bracket **2365** (shown in FIG. **23**) that may be included with the valve meter assembly **1000** to attach the wireless communication unit **2310**. Enclosed within the plastic cover **2320***a,b* is a sealing gasket **2420**, a battery **2430**, a transceiver **2440**, and a printed circuit board (PCB) **2450**. Where a "printed circuit board" or PCB is included in the current description, any circuitry which functions as the PCB is intended to be included in alternative embodiments as a variant of a printed circuit board.

In an embodiment of the valve meter assembly **1000**, the wireless communication unit **2310** may receive signals from the remotely located communicator, or send signals to the remotely located communicator, or both. The wireless communication unit **2310** may include a wireless communication unit circuit **2925** (shown in FIG. **29**) as part of the PCB **2450**. The wireless communication unit circuit **2925** receives signals from the remotely located communicator. The signals may include valve control signals. The valve control signals may direct action of the solenoid **270** to open or to close and, thereby, to change the state of the water supply valve **170**. The wireless communication unit circuit **2925** controls the solenoid **270** in the current embodiment; however, alternative embodiments may include other control circuits for the solenoid **270**.

In one embodiment, the register assembly **2210** may include a PCB (not shown). With reference to the circuit diagram of FIG. **29** and the block diagrams of FIGS. **30** and **31**, the valve meter assembly **1000** includes the register assembly **2210** and the wireless communication unit **2310** in addition to the water supply valve **170**, which itself includes the solenoid **270**. The register assembly PCB may include a register circuit **2910** that reads the register **2220** electronically. The wireless communication unit **2310** includes the wireless communication unit circuit **2925** and is electrically connected to the register circuit **2910**. The wireless communication unit **2310** is also electrically connected to the solenoid **270**. As shown in FIG. **23**, wires **2360** provide the electrical connections. The wires **2360** may be enclosed with tamper-proof jacketing. The battery **2430** of the wireless communication unit **2310** may be included in the electrical circuitry. In one embodiment, the battery is a lithium thionyl battery. The wireless communication unit circuit **2925** performs functions which may include interaction with the register circuit **2910**, interaction with the water supply valve **170**, or communication with one or more remotely located communicators (shown as **2985**) via a network **2975**. In some embodiments, the wireless communication unit circuit **2925** may replace the register circuit **2910** through electrical connection of the register **2220** with the wireless communication unit **2310**. FIG. **29** also displays how the wireless communication unit **2310** is but one unit (wireless communication unit (**1**)) in a mesh network of wireless communication units (**2**-*n*) (shown as **2310'** and **2310"**), which may communicate with one or more remotely located communicators (**1**-*n*) (shown as **2985'** and **2985"**).

FIG. **25** is a cross-sectional view of the assembled valve meter device **100** with the water supply valve **170** in an "open" state. The valve cover **120**, along with the valve portion **265** of the device housing **110**, encloses the diaphragm assembly **260** and spring **250**. The gasketing diaphragm ring **1310** is enclosed within the diaphragm ring recess **560** and the diaphragm ring recess **930**. The strainer retainer **220** is a porous fence that allows water to flow through the meter **210** while retaining particles behind strainer retainer **220**. The strainer retainer **220** is positioned between the meter **210** and the meter inlet portion **350** inside the meter cavity **450**. The bottom plate **150** is attached to the bottom of the device housing **110** with plate screws **160***a,b,c,d* and has the plastic liner **240** and the meter gasket **230** between the device housing **110** and the bottom plate **150**. In this embodiment, the water supply valve **170** and the meter **210** are substantially in line between the inlet **310** and the outlet **320**, as previously defined. The meter gasket **215** seals the interface between the metering outlet **213** and the meter outlet standoff **480**.

As illustrated in FIG. **26**, the media channel pathway **2610** extends from the valve cavity **905** to the valve outlet portion **340**. The media channel pathway **2610** includes the media channel **520**, media channel relief **530**, valve cover media channel **830**, solenoid chamber **940**, and the valve cavity media channel **840**. The valve orifice cylinder **280** is placed inside the valve cover media channel **830**. The action of the solenoid **270** either prevents or allows water flow through the media channel pathway **2610**. The valve orifice cylinder **280** provides the interface with the interface portion **1140** of the plunger **1130**. The valve orifice cylinder **280** is chosen of an appropriate size to prevent excessive fluid flow, as excessive fluid flow will cause the diaphragm assembly **260** to lift away from the beveled edge **550** quickly.

In the current embodiment, the water supply valve **170** is a pilot operated valve. A pilot operated valve is a valve that experiences large-scale operation occurring naturally as a result of a small change in the pilot. As such, small amounts of energy can be used to control large-scale changes as the pilot changes. In the current embodiment, the pilot-operated valve is a diaphragm valve.

In use, the valve meter device **100** may assume one of two states: an "on" or "open" state and an "off" or "closed" state. A "trickle" or "reduced flow" state may be substituted for the "off" or "closed" state in various embodiments. The valve meter device **100** may be configured to assume either of the

two possible states. The states correspond to the positioning of the water supply valve **170**.

The valve meter device **100** will typically be in the open state allowing a maximum, or near maximum, flow rate of water that is allowed to flow through the valve meter device **100**. In the current embodiment, maximum flow rate is about 25 gallons per minute, although other maximum flow rates are possible in accord with this disclosure. When the valve meter device **100** is in the open state, the water supply valve **170** is open. When the water supply valve **170** is open, which occurs when the diaphragm **1230** is substantially lifted away from the beveled edge **550** (as seen in FIG. **25**), the solenoid **270** is in the open position and the interface portion **1140** of the plunger **1130** is actuated away from the valve orifice cylinder **280**, as seen in FIG. **26**.

With reference to FIG. **25**, water travels through the valve meter device **100** originating from a water source and entering in inlet **310**. Water is permitted to travel through the inlet opening **612**, into the inlet neck **622**, and to the horizontal portion **610**. When water reaches the intersection of the horizontal portion **610** and vertical portion **620**, water is directed vertically into the vertical portion **620** by water pressure. Water exits the vertical portion **620** by flowing over the beveled edge **550**. Water fills the valve transition portion **670** and—as will be described in more detail later—the valve cavity **905** and media channel pathway **2610**. Water exits the valve portion **265** via the valve outlet portion **340** and enters the meter inlet portion **350**. Water then enters and fills the meter cavity **450**. Pressure forces water into the metering inlet **212**, through the meter **210**, and out of the metering outlet **213** to the meter outlet portion **360** and outlet **320**. Once the water exits the outlet **320**, the water flows through the downstream piping system and, ultimately, to the user terminal.

The water passing through the meter **210** moves the nutating disc **2110** causing the meter magnet **2130** to rotate. The rotation of the meter magnet **2130** causes the register **2220** to log the motion, leading to a measurement of water usage and a readout of water usage from the register **2220**.

The register circuit **2910** configured to log the readout of water usage at preset timing intervals may be included with one embodiment of the valve meter device **100**. In the current embodiment, the register circuit **2910** remains in a low power mode for the majority of its operating life. Low power, as used in this disclosure, means that the register circuit **2910** is using a very small amount of power when compared to the normal operating mode. This is commonly referred to as being in a "sleep mode." The register circuit **2910** "wakes up" at preset timing intervals to read the register **2220** and log the readout. In the current embodiment, the wireless communication unit circuit **2925** is connected with the register circuit **2910** via wires **2360**. The wireless communication unit circuit **2925** obtains the log of the register circuit **2910** and transmits the log to a remotely located communicator at preset timing intervals. The preset timing interval of the wireless communication unit **2310** may or may not be the same preset timing interval as that of the register circuit **2910**. In alternative embodiments, a separate register circuit **2910** may not be necessary if the wireless communication unit **2310** is capable of directly determining the measurement of water usage of the register **2220**.

The water supply valve **170** is configured in the open state when the interface portion **1140** is lifted away from the valve orifice cylinder **280** because the solenoid **270** is in the open position, as seen in FIG. **26**. The valve cavity media channel **840** provides a water pressure link between the solenoid chamber **940** and the valve cavity **905** such that the water pressure in the valve cavity **905** will be the same as the water pressure in the solenoid chamber **940**. When the solenoid **270** is in the open position, the plunger **1130** is lifted so that the valve orifice cylinder **280** is open to the valve cover media channel **830**. When the valve orifice cylinder **280** is uncovered, water is allowed to flow from the solenoid chamber **940** through the valve cover media channel **830** into the media channel **520** and further into the valve outlet portion **340**. Therefore, the water pressure in the valve cavity **905** is substantially the same as the water pressure in the media channel **520**, the solenoid chamber **940**, the media channel **520**, and the valve outlet portion **340**. Thus, the diaphragm **1230** has no pressure behind it to close the water supply valve **170**. The water supply valve **170** remains open. Although the current embodiment has the valve orifice cylinder **280** located on the valve cover media channel **830** such that there is a pressure link between the valve cavity **905** and the solenoid chamber **940**, the valve orifice cylinder **280** may be located within the valve cavity media channel **840** in alternative embodiments. Other locations for the valve orifice are also contemplated by the current disclosure.

Changing the valve meter device **100** to a closed state requires the water supply valve **170** to be changed to closed. Where a trickle state is included, the water supply valve must be changed to a trickle state, which may be the same as the closed state in various embodiments. This is accomplished by operation of the plunger **1130** moving into a closed position having the interface portion **1140** contacting the valve orifice cylinder **280**, which provides a water-tight seal over the valve cover media channel **830**. In the closed state, the valve meter device **100** allows no water flow through. In the trickle state, the valve meter device **100** allows minimal water flow through. In the current embodiment, minimal water flow is greater than zero gallons per minute and less than about 2 gallons per minute, although other minimal flow rates are possible in accord with this disclosure. FIG. **27** displays the water supply valve **170** in the dynamic state between the open and closed states. In this dynamic state, the solenoid **270** is in the closed position but the diaphragm assembly **260** is has not traveled to the beveled edge **550**. In the current embodiment, the water supply valve **170** is a diaphragm valve with a pressure-controlled pilot operation. To move the valve meter device **100** into the closed state, the solenoid **270** is engaged, or "thrown," and closed onto the valve orifice cylinder **280**. This closes or "severs" the media channel pathway **2610**. Water flow is blocked from the solenoid chamber **940** to the valve cover media channel **830** as well as to the media channel **520** and media channel relief **530** thereby isolating the solenoid chamber **940**, the valve cavity media channel **840**, and the valve cavity **905** as one water pressure pool. Thus, the closing of the solenoid **270** is the pilot operation that triggers the dynamic state of the water supply valve **170**. FIG. **28** displays the water supply valve **170** in the closed state, wherein the interface portion **1140** of the plunger **1130** is in contact with the valve orifice cylinder **280** and the diaphragm assembly **260** has traveled and contacted the beveled edge **550**, sealing the water supply valve **170**.

After the solenoid **270** is closed or thrown, water may no longer exit the valve cavity **905**, so the valve cavity **905** no longer has media pressure behind it. Spring force provided from the diaphragm **1230** or from the optional spring **250** forces the diaphragm assembly **260** down toward the valve inlet portion **330** of the device housing **110**. The spring **250** is optional because, depending on the configuration of the diaphragm **1230**, the diaphragm **1230** may already be biased toward closing the water supply valve **170** without the spring **250**. As the diaphragm assembly **260** moves toward the valve inlet portion **330**, some of the water flowing through the valve

portion 265 will leak through the water leak passthroughs 1260, through the strainer 1240, through the water leak hole 1740, and into the valve cavity 905. The increased volume of water in the valve cavity 905 creates increased pressure in the valve cavity 905. The increased pressure in the valve cavity 905 is applied to the entire surface of the diaphragm 1230 because the valve cavity 905 extends across the entire diaphragm 1230. This increased pressure applied over the entire diaphragm 1230 further biases the diaphragm assembly 260 in the direction of the valve inlet portion 330.

The increased bias causes the diaphragm assembly 260 to travel toward the valve inlet portion 330, eventually seating the bottom of the inner flat portion 1440 of the diaphragm 1230 onto the beveled edge 550 of the top edge portion 640 of the valve inlet portion 330. When the diaphragm 1230 seats onto the beveled edge 550, the water supply valve 170 is in the closed state.

Once the diaphragm 1230 has seated, water pressure from the valve inlet portion 330 equalizes with water pressure in the valve cavity 905 because water can pass into the valve cavity 905 through the valve cone 1210 of the diaphragm assembly 260 but cannot exit the valve cavity 905 down the media channel pathway 2610. With equalized pressure, the water supply valve 170 remains in the closed state because the cross-section of the valve inlet portion 330 provides a smaller surface area over which to apply pressure to the diaphragm 1230 than the surface area of the diaphragm 1230 that interfaces with the valve cavity 905. With the same pressure, a smaller surface area over which the pressure is applied produces a smaller force than the same pressure applied to a larger surface area. The result is a net downward force on the diaphragm 1230, maintaining the water supply valve 170 in the closed state. The trickle state is accomplished by placing the diaphragm 1230 in the same position as the diaphragm 1230 is placed in the closed state. However, in the trickle state, a small amount of water is allowed to bypass the water supply valve 170 via a leak passageway (not shown) in the diaphragm 1230 or a bypass channel (not shown) from the valve inlet portion 330 to the valve outlet portion 340. The bypass channel or leak passageway may be a small bore leading from the valve inlet portion 330 to the valve outlet portion 340 and may be placed in the vertical portion 620, for example. The bore would be small enough that a significant amount of water would not flow through the bore. A sealing valve may allow selective flow through the bore.

To reopen the water supply valve 170, the solenoid 270 is actuated so that the interface portion 1140 lifts away from the valve orifice cylinder 280, opening the media channel pathway 2610. Opening the media channel pathway 2610 establishes a pressure link between all of the components of the media channel pathway 2610, including the valve cavity 905, the valve cavity media channel 840, the solenoid chamber 940, the valve cover media channel 830, the media channel relief 530, and the media channel 520. When the pressure in the valve cavity 905 is reduced, the downward force on the diaphragm 1230 and the diaphragm assembly 260 is also reduced. The pressure in the valve inlet portion 330 provides greater upward force on the bottom of the diaphragm 1230 than the downward force on the top of the diaphragm 1230, which may be provided by the spring 250 or by the inherent bias of the diaphragm 1230. The result is a lifting of the diaphragm assembly 260, thereby opening the water supply valve 170.

The solenoid 270 may be engaged or lifted by manual operation, by electronic actuation, or by remote control. In one embodiment, the wireless communication unit 2310 is capable of receiving electrical signals for the solenoid 270 to control its operation. Actuation of the plunger 1130 in the current embodiment is performed by a solenoid 270, which is a latching solenoid in the current embodiment. A latching solenoid is a solenoid 270 that latches in place. A latching solenoid does not utilize energy once it has achieved its desired position but does use energy to change positions. However, this actuation can be performed via a number of mechanical or electromechanical interfaces, including stepper motors, DC motors, non-latching solenoids, electromagnets and other electromagnetic devices, and spring assemblies, among others. This embodiment would allow a remotely located communicator to control operation of the water supply valve 170, allowing the water supply valve 170 to be changed to an open or closed state from a remote location.

The wireless communication unit 2310 may include a wireless communication unit circuit 2925. The wireless communication unit circuit 2925 may be configured to log the status of the solenoid 270. For example, the communication unit circuit 2925 may log whether the solenoid 270 is in the open or closed position. Because operation of the solenoid 270 controls the water supply valve 170, the status of the solenoid 270 will be substantially the same as the status of the water supply valve 170 unless the water supply valve 170 is non-functioning or the water supply valve 170 is in a dynamic state between open and closed.

In a further embodiment, a valve monitoring circuit 2945 may be implemented. The valve monitoring circuit 2945 monitors the status of the water supply valve 170 by monitoring whether the solenoid 270 should be in the open position or in the closed position. If the solenoid 270 is logged to be in the closed position and the readings from the register circuit 2910 continue to change, the wireless communication unit 2310 may send a distress signal to alert the remotely located communicator that the water supply valve 170 of the valve meter device 100 is not operational. Alternatively, wireless communication unit 2310 may keep track of the expected state of the water supply valve 170 and determine if water flow is detected by the register assembly 2210.

The wireless communication unit 2310 and register circuit 2910 may be powered by a battery 2430. Each may have its own battery or each may be powered by the same battery. In the current embodiment, the solenoid 270, the wireless communication unit 2310, and the register circuit 2910 are all powered by the battery 2430. In the current embodiment, the battery 2430 is a lithium thionyl battery. In the current embodiment, the battery 2430 is capable of providing a nominal voltage of 3.6 VDC and a minimum voltage of 2.9 VDC with minimum available current of 300 mA. Other embodiments may include other electrical specifications.

In some embodiments, indicator lights (not shown) may be included. A valve indicator may be included to indicate the nominal state of the water supply valve 170. A mechanical remote valve indicator may also be included to ensure that actuation of the water supply valve 170 has commenced. Other remote and local indication mechanisms may also be used as well.

FIGS. 30 and 31 display diagrams of control logic for the circuits of the valve meter device 100. The operation of the register circuit 2910 is described by FIG. 30. In operation, the register circuit 2910 awakens on timed intervals as shown in step 3020. The value of the register 2220 is read in step 3030 and compared to previous register values in step 3040. The register circuit 2910 is returned to a sleep state in step 3050. The register circuit 2910 sleeps for a preset timing interval before repeating.

FIG. **31** displays a diagram of the control logic of wireless communication unit circuit **2925**, including interaction with the optional valve monitoring circuit **2945**. The wireless communication unit awakens at present timing intervals as shown in step **3120**. In the current embodiment, the register circuit **2910** awakens, reads the register value, and compares the current value with the previous value as shown by step **3010**. Following the step **3010**, the wireless communication unit circuit **2925** stores the compared value from the register circuit **2910**, as shown in step **3130**, and sends that compared value to a remotely located communicator as shown with step **3140**. Although the compared value from the register circuit **2910** is stored in memory in the current embodiment, the storing step need not be implemented in all embodiments, and in alternative embodiments, the storing step may be included with the remotely located communicator instead of with the wireless communication unit circuit **2925**.

Included in this embodiment is the valve monitoring circuit **2945**. However, the valve monitoring circuit **2945** may not be present in all embodiments, as depicted by step **3142** in FIG. **31**. If a valve monitoring circuit **2945** is present, the status of the water supply valve **170** is logged by determining whether the solenoid **270** is in the open or closed position, represented by step **3155**. The valve monitoring circuit **2945** also logs the most recent compared value from the register circuit **2910** as shown in step **3165**. If the status of the water supply valve **170** is open or on, the circuit bypasses further logic, as represented by step **3172**, and proceeds to allow the wireless communication unit circuit **2925** to sleep as in step **3150**. If the status of the water supply valve **170** is closed or off, the valve monitoring circuit **2945** includes further steps. As represented by step **3175**, the most recent compared value of the register circuit **2910** is compared to prior values of the register circuit **2910** that are logged in memory of the valve monitoring circuit **2945**. If the most recent compared value of the register circuit **2910** is substantially different from prior compared values of the register circuit **2910**, shown by step **3182**, the valve monitoring circuit **2945** is configured to send a distress signal from the wireless communication unit **2310** to the remotely located communicator, represented by step **3185**. The valve monitoring circuit **2945** then continues to sleep the wireless communication unit circuit **2925**, as shown by step **3150**, which sleeps for a preset timing interval before repeating.

One should note that conditional language, such as, among others, "can," "could," "might," or "may," unless specifically stated otherwise, or otherwise understood within the context as used, is generally intended to convey that certain embodiments include, while other embodiments do not include, certain features, elements, and/or steps. Unless stated otherwise, it should not be assumed that multiple features, embodiments, solutions, or elements address the same or related problems or needs. Thus, such conditional language is not generally intended to imply that features, elements, and/or steps are in any way required for one or more particular embodiments or that one or more particular embodiments necessarily include logic for deciding, with or without user input or prompting, whether these features, elements, and/or steps are included or are to be performed in any particular embodiment.

It should be emphasized that the above-described embodiments are merely possible examples of implementations, merely set forth for a clear understanding of the principles of the present disclosure. Any physical properties described above should be understood as representing one of many possible embodiments, and alternate implementations are included depending on the functionality involved, as would be understood by those reasonably skilled in the art of the present disclosure. Many variations and modifications may be made to the above-described embodiment(s) without departing substantially from the spirit and principles of the present disclosure. Further, the scope of the present disclosure is intended to cover any and all combinations and sub-combinations of all elements, features, and aspects discussed above. All such modifications and variations are intended to be included herein within the scope of the present disclosure, and all possible claims to individual aspects or combinations of elements or steps are intended to be supported by the present disclosure.

The invention claimed is:

1. An assembly comprising:

a housing, the housing defining at least one inlet opening, at least one outlet opening, and a channel connecting the at least one inlet opening and the at least one outlet opening, the at least one inlet opening having an inlet end and the at least one outlet opening having an outlet end, there being a linear distance between the inlet end and the outlet end, the linear distance being no greater than a standard water meter lay-length;

a water meter positioned in the channel, the water meter configured to monitor a flow of water through the assembly;

a valve in communication with the channel and configured to control the flow of water through the assembly;

a communications device configured to send signals to a remotely located communicator; and

a valve monitoring circuit, wherein the valve monitoring circuit includes:

logic configured to monitor a state of the valve, the state including an open state and at least one of a closed state and a trickle state; and

logic configured to determine if water is flowing through the meter;

wherein the signals include a distress signal if at least one of a first condition and a second condition are met,

wherein the first condition is that water is flowing through the meter when the state of the valve is in the closed state, and

wherein the second condition is that water is flowing through the meter in excess of a predetermined amount when the state of the valve is in the trickle state.

2. The assembly of claim **1**, wherein the communication device is connected to the assembly by an electrical connection.

3. The assembly of claim **1**, wherein the communication device is configured to receive signals from a remotely located communicator.

4. The assembly of claim **1**, wherein the communication device is a wireless communication unit.

5. The assembly of claim **1**, wherein the valve is configurable to assume one of at least two of three states, the states including an open state, a closed state, and a trickle state.

6. The assembly of claim **1**, wherein the standard water meter lay-length is seven and one-half inches.

7. The assembly of claim **1**, wherein at least a portion of the valve resides in the housing.

8. The assembly of claim **1**, wherein the valve is a pilot operated valve.

9. The assembly of claim **1**, wherein the valve is a diaphragm valve.

10. An assembly for use with a water meter, the assembly comprising:

a housing including a body portion, at least one inlet, and at least one outlet, the inlet having an inlet end and the

outlet having an outlet end, the housing including an outer surface and an inner surface, the inner surface shaped to receive the water meter and defining an internal cavity of the body portion, the internal cavity of the body portion including an inlet and an outlet;

a valve in sealable communication with the inner surface, wherein the valve and the water meter are placed about in line between the at least one inlet and the at least one outlet;

a communications device configured to send signals to a remotely located communicator; and

a valve monitoring circuit, wherein the valve monitoring circuit includes:

logic configured to monitor a state of the valve, the state including an open state and at least one of a closed state and a trickle state; and

logic configured to determine if water is flowing through the meter;

wherein the signals include a distress signal if at least one of a first condition and a second condition are met,

wherein the first condition is that water is flowing through the meter when the state of the valve is in the closed state, and

wherein the second condition is that water is flowing through the meter in excess of a predetermined amount when the state of the valve is in the trickle state.

11. The assembly of claim **10**, wherein the internal cavity inlet portion defines a substantially rectangular opening.

12. The assembly of claim **10**, wherein the communication device is a wireless communication unit.

13. The assembly of claim **10**, wherein the valve is a pilot operated valve.

14. The assembly of claim **10**, wherein the housing is made of a non-ferrous material.

15. An assembly comprising:

a housing including at least one inlet and at least one outlet, the housing defining at least one inlet opening, at least one outlet opening, and a channel substantially connecting the at least one inlet opening and the at least one outlet opening, the at least one inlet opening having an inlet end and the at least one outlet opening having an outlet end, there being a linear distance between the inlet end and the outlet end, the linear distance being no greater than a standard water meter lay-length;

a water meter residing in the housing and in communication with the channel;

a valve in communication with the channel, wherein the valve and the meter is placed in line between the inlet end and the outlet end;

a communications device configured to send signals to a remotely located communicator; and

a valve monitoring circuit, wherein the valve monitoring circuit includes:

logic configured to monitor a state of the valve, the state including an open state and at least one of a closed state and a trickle state; and

logic configured to determine if water is flowing through the meter;

wherein the signals include a distress signal if at least one of a first condition and a second condition are met,

wherein the first condition is that water is flowing through the meter when the state of the valve is in the closed state, and

wherein the second condition is that water is flowing through the meter in excess of a predetermined amount when the state of the valve is in the trickle state.

16. The assembly of claim **15**, wherein the valve is controlled by valve control signals.

17. The assembly of claim **15**, wherein the standard water meter lay-length is seven and one-half inches.

18. The assembly of claim **15**, wherein the valve is a pilot operated valve.

19. The assembly of claim **15**, wherein the housing is made of a non-ferrous material.

20. A method of monitoring a valve meter assembly comprising the steps of:

monitoring a flow of water through a valve meter assembly;

monitoring a status of a water supply valve, the status describing the position of the water supply valve, the status including at least one of open, closed and trickle;

transmitting signals with a communication device;

measuring a first flow of water value through the valve meter assembly;

measuring a second flow of water value through the valve meter assembly;

comparing the first flow of water value and the second flow of water value; and

transmitting a distress signal if the first flow of water value and the second flow of water value are not the same value and the status of the water supply valve is one of closed and trickle.

* * * * *

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Broniak et al.

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(45) **Date of Patent: Apr. 28, 2015**

(54) **ENERGY MANAGER—WATER LEAK DETECTION**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 585 days.

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G01M 3/28 (2006.01)
E03B 7/07 (2006.01)

(52) **U.S. Cl.**
CPC ***G01M 3/2807*** (2013.01); ***E03B 7/075*** (2013.01)

(58) **Field of Classification Search**
CPC G01F 15/06-15/07
USPC 340/870.02, 606, 605; 73/46, 195; 702/45, 46, 100
See application file for complete search history.

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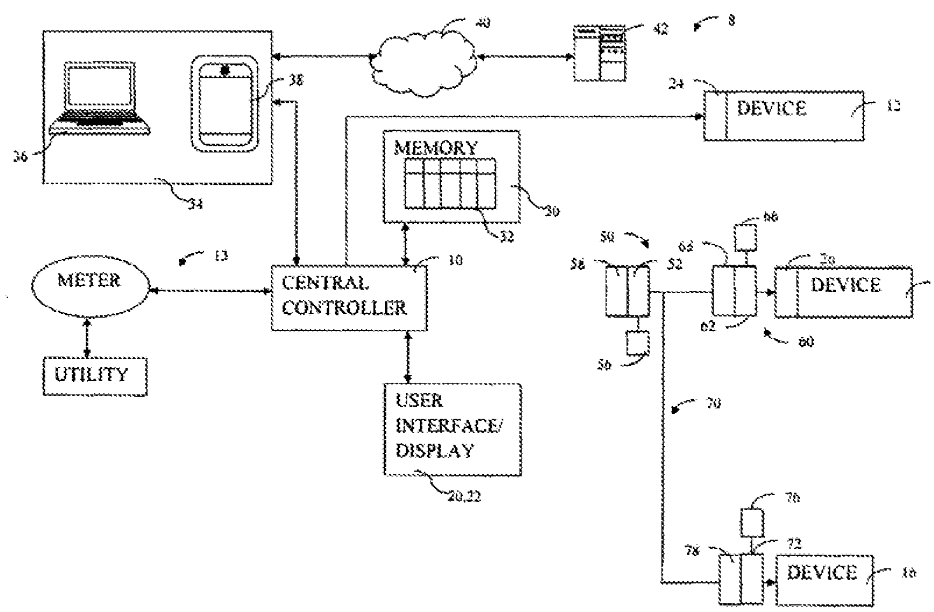
(57) **ABSTRACT**

Methods and systems are disclosed for monitoring water leaks within a home. A home network with various devices monitors these devices with a controller. Information is received from a water flow meter via a transceiver for tracking a total water flow amount through pipelines in the home. By comparing information collected to a predetermined threshold, a leak is determined as present or not within each pipeline. Upon the detection of a leak in the home, a home owner is notified of the condition so that action is taken expeditiously. A shut off valve can be triggered remotely when a request is received from the user, which closes the water pipeline to prevent water damage.

18 Claims, 3 Drawing Sheets



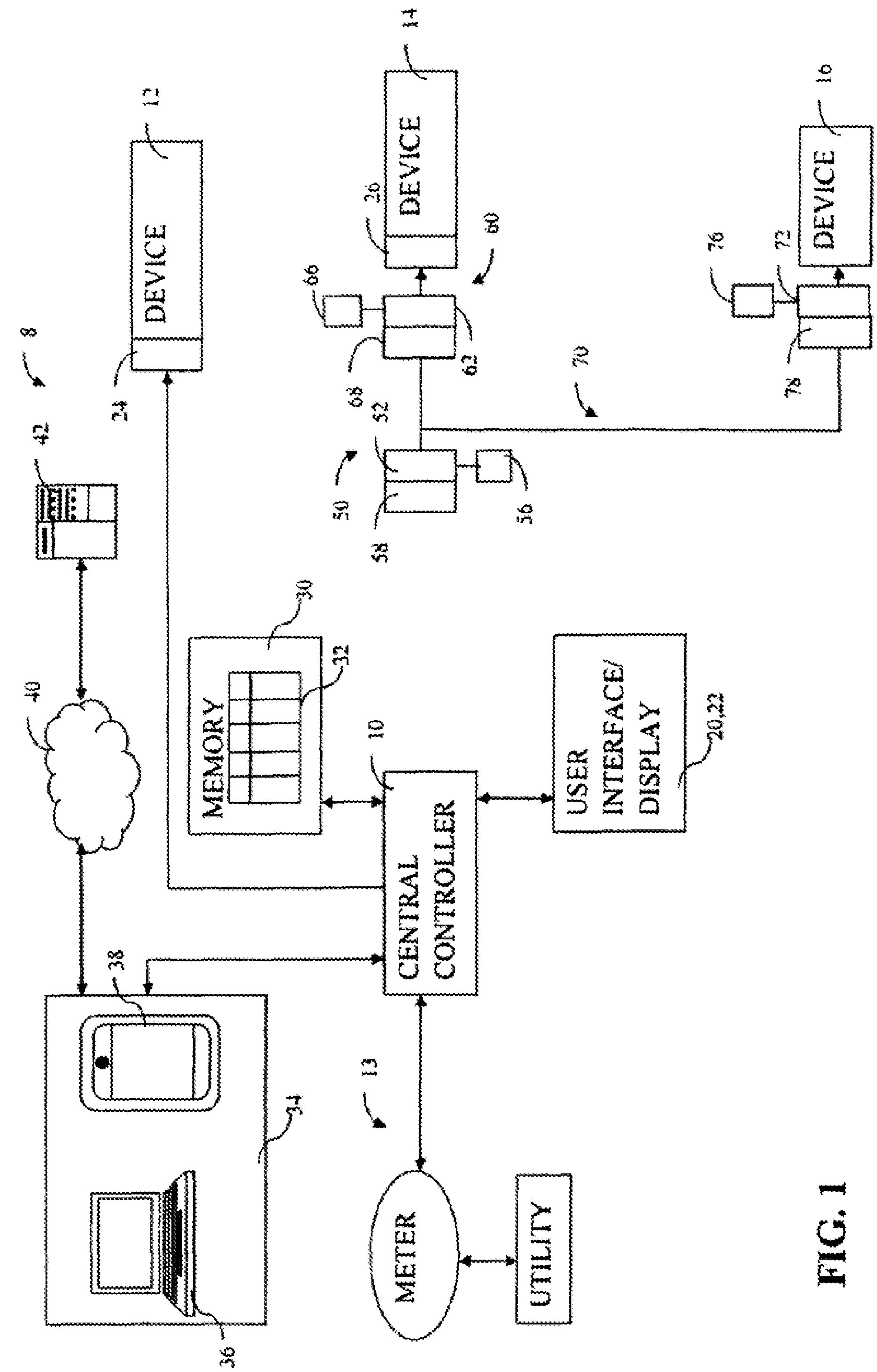

DEVICE
DEVICE
DEVICE
MEMORY
CENTRAL CONTROLLER
USER INTERFACE/ DISPLAY
METER
UTILITY

FIG. 1

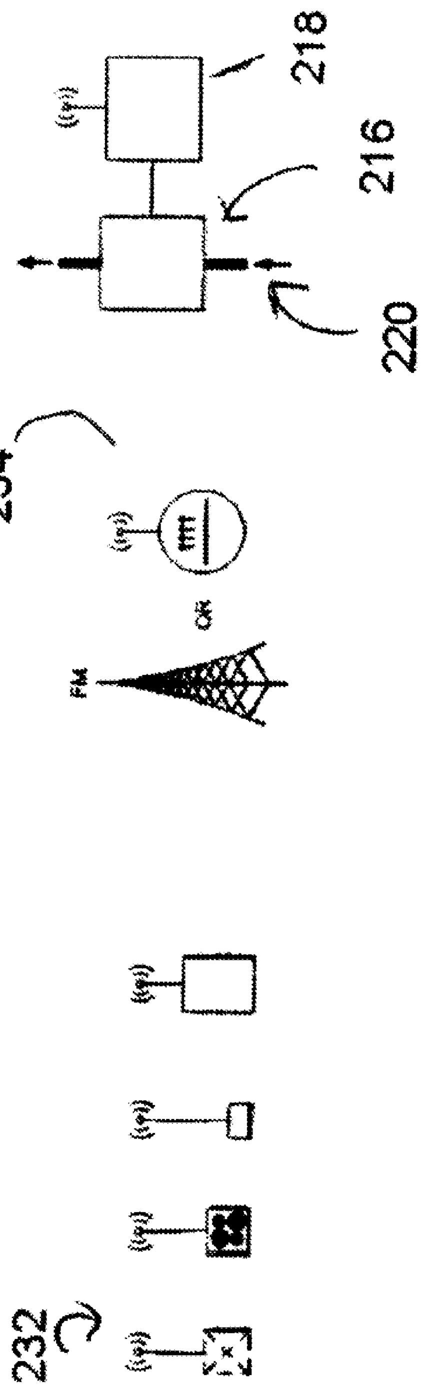


FIG. 2

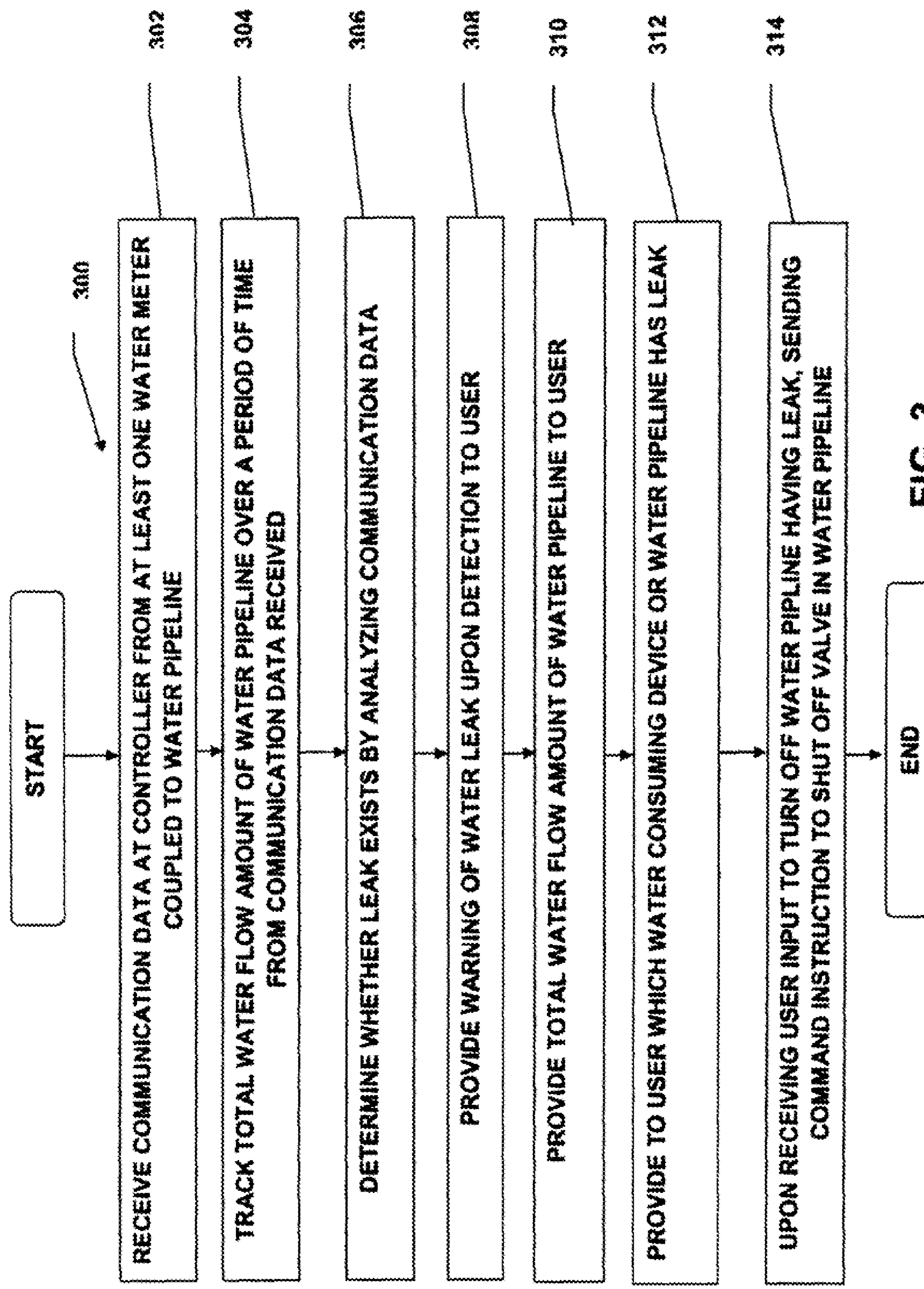

300
START
302
RECEIVE COMMUNICATION DATA AT CONTROLLER FROM AT LEAST ONE WATER METER COUPLED TO WATER PIPELINE
304
TRACK TOTAL WATER FLOW AMOUNT OF WATER PIPELINE OVER A PERIOD OF TIME FROM COMMUNICATION DATA RECEIVED
306
DETERMINE WHETHER LEAK EXISTS BY ANALYZING COMMUNICATION DATA
308
PROVIDE WARNING OF WATER LEAK UPON DETECTION TO USER
310
PROVIDE TOTAL WATER FLOW AMOUNT OF WATER PIPELINE TO USER
312
PROVIDE TO USER WHICH WATER CONSUMING DEVICE OR WATER PIPELINE HAS LEAK
314
UPON RECEIVING USER INPUT TO TURN OFF WATER PIPLINE HAVING LEAK, SENDING COMMAND AND INSTRUCTION TO SHUT OFF VALVE IN WATER PIPELINE
END

FIG. 3

ENERGY MANAGER—WATER LEAK DETECTION

BACKGROUND

The present disclosure relates generally to methods for monitoring water pipelines and water consuming devices of a home network and systems for operating the same. More particularly, it relates to monitoring water flow of water pipes and detecting leaks therein.

A leaky pipe in a home always occurs at the worst possible moment. The leak may come from any number of devices or pipes in the home. The damage that results varies from no damage at all to major repairs and cost having to be expended. In some instances, water consuming devices in the home have malfunctioned and need to be replaced. When appliances break down that are often part of everyday life, the leak may be quickly noticeable and a fix can be quickly pursued.

For example, water heating storage tanks are used for storing and supplying hot water to households. A typical residential water heater holds about fifty gallons (190 liters) of water inside a steel reservoir tank. A thermostat is used to control the temperature of the water inside the tank. Many water heaters permit a consumer to set the thermostat to a temperature between 90 and 150 degrees Fahrenheit (F) (32 to 65 degrees Celsius (C)). To prevent scalding and to save energy, most consumers set the thermostat to heat the reservoir water to a temperature in a range between 120.0 degrees F. to 140.0 degrees F. (about forty-nine degrees C. to sixty degrees C.). As water heating and storage systems typically have a lifespan of about fifteen to twenty years varying upon the type of system. With age, the possibility of a leak in the pipes to the system increases, which potentially cause damage to the surrounding home structure, such as water through a ceiling. In addition, if a leak is not large enough to be immediately noticeable the efficiency of the water heater is compromised, and thus, a homeowner's water cost, heating and storage efficiency can suffer.

When a leak is present within a pipe, however, the leak may not be as noticeable as water dripping from the ceiling or a flooded basement when a hot water heater has broken down. Various pipes are often interlocked throughout a home to supply a continuous supply of water to many various devices (e.g., refrigerator faucets, washers, etc.). Pipeline leaks have the potential to go unnoticed for longer periods of time, if the leak is small. However, over time an equal or greater amount of damage may ensue. Damage includes loss to structure, foundational shifting, water utility cost increases, increased mold and insect infestation, etc. from a continuous flow of water leaking.

Thus, there is a need for a system that can reduce the amount of damage and cost to homes by quickly identifying leaky pipes or devices spilling water into the home and notifying the owner.

SUMMARY

The present disclosure provides a method for use within an energy management system that alerts the homeowner of a potential water leak. A central controller (e.g., a home energy manager) communicates wired/wireless signals to one or more water meters coupled to a main water pipeline and/or to various water consuming devices, such as a washer, dishwasher, sinks, toilet, etc throughout the home. The water consumption for each device and/or pipeline coupled thereto, and if a value that is out of range of the average is detected or exceeds a predetermined threshold value, the home owner is notified via a system display, a text message, or other communication method about the leak.

In one embodiment, a home network with a central controller includes at least one water meter or flow meter for measuring water that is consumed by a water consuming device. The central controller communicates with the water meter to receive information about the water flow. The central controller tracks a total water flow amount of the water pipeline during a period of time. A leak is determined as existing by comparing the total water flow amount through the pipe over the period of time to a predetermined threshold. If the water flow amount is greater than the expected threshold amount over the period of time, a potential leak has been detected. Upon determining the leak as existing, a warning from the central controller of the home is provided to the user.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of a water monitoring system in accordance with an illustrative embodiment of the present disclosure;

FIG. 2 illustrates water measuring and communication devices in accordance with an illustrative embodiment of the present disclosure; and

FIG. 3 illustrates a flow diagram for monitoring water consumption of a home.

DETAILED DESCRIPTION

Referring to FIG. 1, illustrated is an exemplary home energy management system **8** for one or more devices **12**, **14** and **16** communicatively linked to a home area network. The devices **12**, **14** and **16** comprise electronic devices, devices that are electronic and water consuming with a water pipeline connected, and devices that are only water consuming without any electronics necessary. For example, the device **12** includes one or more home appliances or processing elements of a home that does not have a water pipeline connected to it and is not a water consuming device. The device **14** includes a water consuming device that is operational with an electronic device control board **26**, (e.g., a dishwasher or refrigerator), and the device **16** comprises one or more water consuming devices, which does not have an electronic control therein, such as a toilet, sink or faucet. For example, the device **14**, and/or **16**, is a water heater, a toilet, a sink, a shower, an outdoor faucet of any kind, a water storage tank, a dishwasher, a refrigerator, any washing machine, and/or any device connected to a water line. The device **12** may also be one or more appliances (e.g., HVAC unit, or other home appliance), or processors, such as a home energy manager or a programmable communicating thermostat, or any other energy consuming devices other than appliances or water consuming devices that are coupled to the home network. The devices within the system **8**, therefore, include both water consuming and electrically operated devices, and combinations thereof.

The home energy management system **8** includes a central controller **10** for managing power consumption and monitoring water consumption within a household. The controller **10** includes a micro processor, which is programmed to selectively send and/or receive signals to a device control board **24** and **26** of devices **12** and **14**, for example, in response to the input signal it receives. The device controllers **24** and **26**, in turn, are operable to manipulate energizing of the power consuming features/functions thereof according to a programming selection.

Within the home management system **8**, the central controller **10** is configured to receive a signal **13** by a receiver and process the signal indicative of one or more energy parameters and/or a utility state of an associated energy supplying utility, for example, including availability and/or current cost of supplied energy. There are several ways to accomplish this communication, including but not limited to power line carrier (PLC) (also known as power line communication), FM, AM SSB, WiFi, ZigBee, Radio Broadcast Data System, 802.11, 802.15.4, etc. The energy signal may be generated by a utility provider, such as a power company or energy provider, and can be transmitted via a power line, as a radio frequency signal, or by any other means for transmitting a signal when the utility provider desires to reduce demand for its resources. The cost can be indicative of the state of the demand for the utility's energy. For example, a relatively high price or cost of supplied energy is typically associated with a peak demand state/period and a relative low price or cost is typically associated with an off-peak demand state/period.

The controller **10** is configured to communicate with, control and/or operate the devices **12** and/or **14** in one of a plurality of operating modes, including at least a normal operating mode and an energy savings mode in response to the received signal. Specifically, the devices **12** and/or **14** can be operated in the normal operating mode during the off-peak demand state or period and can be operated in the energy savings mode during the peak demand state or period. The central controller **10** can be configured to communicate with the devices, in no particular necessary manner or protocol, to precipitate the return of the devices to the normal operating mode after the peak demand period is over. Alternatively, the control board of each appliance could be configured to receive communication directly from the utility, process this input, and in turn, invoke the energy savings modes, without the use of the centralized controller **10**.

The devices **14** and **16**, which are water consuming devices, receive water from a main water inlet pipe **50** for moving water thereto. The main inlet pipe **50**, for example, provides water to all devices of the home that consume water, such as through branch pipelines **60** and **70** that run from the main water inlet pipe **50** to devices **14** and **16** respectively. The device **14** includes the device control board **26**, which communicates through a wired connection or a wireless communication with the central controller **10**. In addition, the branch water pipelines **60** and **70** connected to the devices **14** and **16** are communicatively coupled to the central controller **10** via communication device **66** and **76**, such as through a wired or wireless transmitter device. Water meters or flow meters **62** and **72** are operable to measure an amount of water that flows through the pipelines **60** and **70** and communicate information about the water flow to the controller **10**.

A main water meter **52** is operatively connected to the main water inlet pipe **50** for measuring a total amount of water flow into the home and communicating information gathered to the controller **10** via a communication module **56**. For example, the central controller **10** receives information from the flow meters **52**, **62** and **72** on the total amount of water flowing through pipelines **50**, **60**, and **70** respectively over a period of time, such as in about an hour or less, for example. Each hour or in less time, therefore, the central controller **10** determines the water flow going through the pipe to determine if a leak condition exists in the pipe or device connected thereto. If the water flow exceeds a certain predetermine threshold amount, a leak is determined as existing. The predetermined threshold for determining the presence of a leak may be different for different devices and based on the amount of use a device gets over a period of time, as well as by other factors. For example, whether a water flow is continuous for an extended period of time or sporadic may also be factored into the determination. In addition, if a water flow in the pipe is excessive, a leak may be determined once a certain amount has been exceeded for a given period of time, so that if the pipe is connected to a shower device for bathing, for example, a leak would not be determined until more than an expected amount of water flows through the pipe. This threshold amount is variable depending upon the type of water consuming device. In one embodiment, the predetermined threshold may be an average amount of water based on historical use of the water consuming device with allowance for a standard deviation, for example.

In one example, a typical flow rate of a showerhead is ~2 gal/min. The homeowner could easily time the length of a typical shower. Assuming his/her average shower length is 12 minutes, this would result in the flow meter measuring 24 gallons over the 12 minutes. The user could then set the predetermined threshold value to 30 gal. If the controller ever saw **30** plus gallons being consumed over 15 minutes, then it could notify the homeowner of a possible leak.

In addition, another option would be for the controller to learn this behavior by monitoring the flow meter over the course of days/weeks. Once it learns the max value that is consumed over a given length of time it could add a buffer, to avoid the nuisance trips, and set this value as the predetermined threshold.

Another example of detecting unintended water usage involves monitoring usage by toilets which occasionally leak in the sense of failing to fully terminate the fill operation after being flushed. A typical toilet holds between 1 and 4 gallons of water. It typically takes 1-2 minutes for a toilet to refill after being flushed. In order to detect such a leak while allowing for back-to-back flushes, a threshold could be set on the order of 10 gallons over a 5 minute period. If the controller detects **10** plus gallons being consumed over 5 minutes it could notify the homeowner of a possible leak.

The controller **10** includes a user interface **20** having a display **22** and control buttons for making various operational selections. The display can be configured to provide active, real-time feedback to the user on the cost of operating each device **12**, **14**, **16**, as well as water consumption information for the water consuming devices **14** and **16**. The costs are generally based on the current operating and usage patterns and energy consumption costs, such as the cost per kilowatt-hour charged by the corresponding utility or a cost per gallon of water, for example. The controller **10** is configured to gather information and data related to current usage patterns and as well as current power costs, and generate historical usage charts therefrom. This information can be used to determine current energy usage and cost associated with using each device and in each mode an electronic device may be in. This real-time information (i.e., current usage patterns, current power cost, current energy usage/cost and water consumption) can be presented to the user via the display.

In one exemplary embodiment, the controller **10** connects via either Ethernet or WiFi to the homeowner's router and to a client application **34**, for example, in a personal computer **36** and/or a mobile device **38**. The controller **10** also has the ability to periodically transmit data to a central server on the Internet **40**. This allows for remote service and monitoring capability. A server **42** can keep records of all homes therein that may be accessed remotely via the Internet.

In another embodiment, the total amounts of water flow through the pipelines **50**, **60** and **70** are provided to the user, such as in the user display **22**. In addition, a warning message can be sent to a user or homeowner about a leak that has been

detected within one of the pipelines. For example, if a water flow in pipeline **70** is determined to have a leak, then a text message, email, and/or a user display message may be transmitted via the internet or on the user display **22** to inform the homeowner of a leak. Where multiple meters are placed at the main water inlet pipe **50** with meter **52** and at branch pipelines **60** and/or **70**, the location of the leak or the device, which is the cause or source of the leak, can also be communicated in a message to the user.

In another embodiment, the system **8** includes shut off valves **58**, **68**, and **78** at respective pipelines **50**, **60** and **70**. The central controller **10** may receive input from the user or homeowner in response to the warning or message, and the user, for example, may respond with instructions to shut off the pipelines **50**, **60**, and/or **70** via the respective shut off valve **58**, **68** and **78**. In this manner, leaks are detected within a home and homeowners are informed of the conditions in which the water consuming devices operate. Informed decisions regarding water usage are made by the homeowner and potentially catastrophic water destruction in a home is more easily avoided. The user also has control over the water flow by enabling a shut off of any particular pipeline, such as to the whole home through the main pipeline **50** or at branch pipelines **60** and/or **70**.

For example, FIG. **2** illustrates an example of a measuring device, such as a flow meter **216** for measuring the amount of water used by various types of water consuming devices. A central controller of a home network communicates wirelessly, for example, to radios that are connected to various sensors. There are several ways to accomplish this communication, including but not limited to power line carrier (PLC) (also known as power line communication), FM, AM SSB, WiFi, ZigBee, Radio Broadcast Data System, 802.11, 802.15.4, etc. The controller of FIG. **1** may communicate directly therefore via a wired, optical and/or wireless connection, and the present disclosure is not limited to any one specific method for communicating.

Different natural resources may be monitored by the central controller **10**. For example, water measurement may be monitored where the system includes a water meter **216** and a communication module that is a wireless radio module **218**, for example. The water meter **216** is inserted into the home's incoming water line **220**. The water meter **216** gives an output for each gal/liter/etc. of water consumed, for example, over or during a period of time. This output is sent to the radio module **218** that in turn sends the information back to the central controller **10**. In one embodiment, the water utility can directly send the consumption data to the central device controller **10** via any available means, including 802.15.4 Zigbee, the Internet or IP connection **40**.

Local utility and rate information is also broadcast at blocks **234** from the utility or energy provider to the controller **10** directly. The controller **10** can receive rate and schedule information as well as demand side management DSM signals to pass them on to the household appliances, such as devices **232**.

The devices **232** may also transmit energy/power consumption, as well as water consumption information to the central controller **10**. Referring back to FIG. **1**, the controller **10** further comprises a memory **30** having at least table **32** that collects water consumption data, energy consumption, generation and/or storage data for a home or other structure (e.g., warehouse, business, etc.). The table may additionally comprise variables associated with the heating and cooling conditions of the home, for example. A table is generated for each monitored device that includes historical home data and data that is currently updated, which may be used in a client application running on a device, such as a computer or mobile phone, for presenting graphs or other data to the user.

The operation of each device **12** and/or **14** may vary as a function of a characteristic of the utility state and/or supplied energy. Because some energy suppliers offer time-of-day pricing in their tariffs, price points could be tied directly to the tariff structure for the energy supplier. If real time pricing is offered by the energy supplier serving the site, this variance could be utilized to generate savings and reduce chain demand.

Building on the ability of the central controller to periodically upload data to a central server, the system **8** has the capability for the homeowner to log onto a secure web portal and view data from their home. This will allow consumers additional flexibility to monitor their home while away.

Example methodology **300** for monitoring a home for a leak is illustrated in FIG. **3**. While the methods are illustrated and described below as a series of acts or events, it will be appreciated that the illustrated ordering of such acts or events are not to be interpreted in a limiting sense. For example, some acts may occur in different orders and/or concurrently with other acts or events apart from those illustrated and/or described herein. In addition, not all illustrated acts may be required to implement one or more aspects or embodiments of the description herein. Further, one or more of the acts depicted herein may be carried out in one or more separate acts and/or phases.

The method **300** of FIG. **3** allows monitoring of pipelines and/or water consuming devices connected to the pipelines for a leak. The method is provided for a home network at a home that includes at least one water meter for measuring water consumed by water consuming devices within the network. A central controller is communicatively linked to the water meter and includes a memory storing executable instructions for the method. The method begins at start and at **302** a communication is received by the central controller from at least one water meter, which is operatively coupled to a water pipeline for measuring water flow. The water meter can be a flow meter that is inserted in the water line or some other measuring device coupled the water pipe of a home capable of measuring water amounts or water flow amounts in a pipeline. The water pipelines include a main water pipeline and branch pipelines connected to the main pipeline and water consuming devices. Communications are received by the controller for more than one water pipeline and from more than one meter for tracking individual water pipelines and water consuming devices connected thereto. The flow meter at each pipeline, for example, has a communication module connected that wirelessly or in a wired fashion transmits communication data to the controller.

At **304** the controller tracks the information received, such as by storing the information in a memory, and over a period of time the data can be used to calculate a total water flow amount going through the pipeline. A water flow rate, an average water amount, a total water amount, for example, can be calculated by the flow meter. The period of time may vary and could be about sixty minutes or less, for example. Other increments of time are also possible.

At **306** whether a leak exists within the pipelines of the home is determined by analyzing the data received. For example, a total water flow amount over the period of time may be compared to a predetermined amount, which is a maximum threshold designated for the pipeline or may be an average amount with a standard deviation limit set. If the total water flow amount exceeds the predetermined threshold, then a leak is determined as present, for example. At **308** a warning is provided to the homeowner or user, which may be via an

internet connection of the home network, via text, email, and/or on a user display at the home. Any means of communication is foreseeable and not outside the scope of this disclosure. At **310** the total water flow amount and/or other measurements gathered regarding the water in the pipelines may be also provided to the user. This can enable better and informed decisions for conserving water at the home. At **312** where the leak is present is determined and the user is provided the particular water consuming device or water pipeline that is experiencing the leak.

At **314** the network may receive a response from the user to shut off different pipelines or the main water inlet pipeline to the home via shut off valve. The controller sends information to the meter for controlling the valve. In one example, a solenoid device may be used for operating the shut off valve and sealing off the pipeline where the leak exists or the main water line pipe to the home.

The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations.

What is claimed is:

1. A method for monitoring a home for a leak within a home network that includes a water meter for measuring water consumption within the home network and a central controller communicatively linked to the water meter, the central controller including at least one memory for storing executable instructions, the method comprising:

tracking a total water flow to a water consuming device for a period of time;

identifying a maximum amount of the total water flow to the water consuming device that occurs during a subinterval length of time in the period of time;

assigning the maximum amount to a threshold value;

receiving communication data at the central controller, the communication data reflecting a total water flow amount from a water pipeline that is operatively coupled to the water meter;

tracking the total water flow amount of the water pipeline over the subinterval length of time from the water meter;

analyzing the total water flow amount by comparing the total water flow amount to the threshold value; and

generating an output to an end user that alerts the end user of a leak when the total water flow amount exceeds the threshold value for the subinterval length of time.

2. The method of claim **1**, wherein the water pipeline comprises a main pipeline having a plurality of branch pipelines coupled thereto, wherein the plurality of branch pipelines provide water to different water consuming devices.

3. The method of claim **1**, wherein the water consuming device includes one of a toilet, a sink, a shower, an outdoor faucet, a washing machine, a dishwasher, a refrigerator, a water storage device, and home device having a secondary pipeline connected to the water pipeline.

4. The method of claim **1**, wherein the subinterval length of time is less than about sixty minutes.

5. The method of claim **2**, further comprising identifying the water consuming device or the branch water pipeline in which the leak is located.

6. The method of claim **5**, wherein the output comprises a communication message that identifies which water consuming device or water pipeline has the leak.

7. The method of claim **1**, wherein the output comprises a warning from the central device to the end user upon detecting the leak via at least one of a text message, an email, a phone message, and a user interface display operatively coupled to the controller.

8. A method for monitoring a home for a leak within a home network that includes a plurality of water flow meters for measuring water being consumed by water consuming devices within the network and a central controller communicatively linked to the water meters and the water consuming devices, the controller including at least one memory for storing executable instructions, said method comprising:

tracking a total water flow amount for each water pipeline of a plurality of water pipelines respectively coupled to a plurality of water consuming devices within the home network over a period of time;

identifying a maximum amount of the total water flow to the water consuming device that occurs during a subinterval length of time in the period of time;

assigning the maximum amount to a threshold value; and

determining whether a leak exists at the home by comparing the total water flow amount of each water pipeline to the threshold value set for each of the water consuming devices.

9. The method of claim **8**, further comprising identifying the particular water consuming device and/or water pipeline in which the leak exists, wherein water pipelines of the plurality of water pipelines respectively have a different threshold value for determining whether the leak exists.

10. The method of claim **9**, further comprising providing a warning from the central controller to an end user of the home to indicate that the leak exists and from which water consuming device and/or water pipeline the leak originates.

11. The method of claim **8**, wherein each water pipeline is operatively coupled to at least one of the flow meters that measure the total water flow amount incoming to the home and to each water consuming device.

12. The method of claim **11**, further comprising receiving communications data at the central controller from the flow meters via a wireless transmitter, wherein the communications data indicates a total water flow amount for each water pipeline and/or a total water flow amount for the home.

13. The method of claim **10**, further comprising receiving an input from the user indicating whether to turn the water pipeline with the leak off; and in response to the input, sending a communication command to trigger a shut off valve to stop water flow in the water pipeline.

14. An energy management system for a home network comprising water consuming devices coupled to water inlets at a home, said energy management system comprising:

a central controller comprising a processor and memory for storing executable instructions;

a water flow meter coupled to a water pipeline for each of the water consuming devices, wherein the water flow meter is configured to measure a total water flow amount in the water pipeline;

a communication device coupled to the flow meter, the communication device configured to communicate the total water flow amount to the central controller; and

a user device display operatively connected to the central controller that provides the total water flow amount to an end user,

wherein the executable instructions include instructions for:

tracking the total water flow amount to the water consuming device over a period of time;

identifying a maximum amount of the total water flow to the water consuming device that occurs during a subinterval length of time in the period of time;

assigning the maximum amount to a threshold value; and

determining whether a leak exists at the home by comparing the total water flow amount of each water pipeline to the threshold value set for each of the water consuming device.

15. The system of claim **14**, wherein the central controller is configured to provide a warning to the end user that a leak exists in the water pipeline based on the total water flow amount exceeding the threshold value over the subinterval length time.

16. The system of claim **14**, further comprising a shut off valve located at the water pipeline to shut off water flow therein upon the controller receiving an input from the end user to shut off the water pipeline.

17. The system of claim **14**, wherein the at least one water pipeline is a main water pipeline that provides water to the home and the water consuming devices.

18. The system of claim **14**, wherein the water consuming devices include one of a toilet, a sink, a shower, an outdoor faucet, a washing machine, a dishwasher, a refrigerator, a water storage device and home device having the secondary pipeline connected to the main water pipeline.

* * * * *

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Palayur (43) **Pub. Date: Feb. 10, 2011**

(54) **WATER MANAGEMENT SYSTEM**

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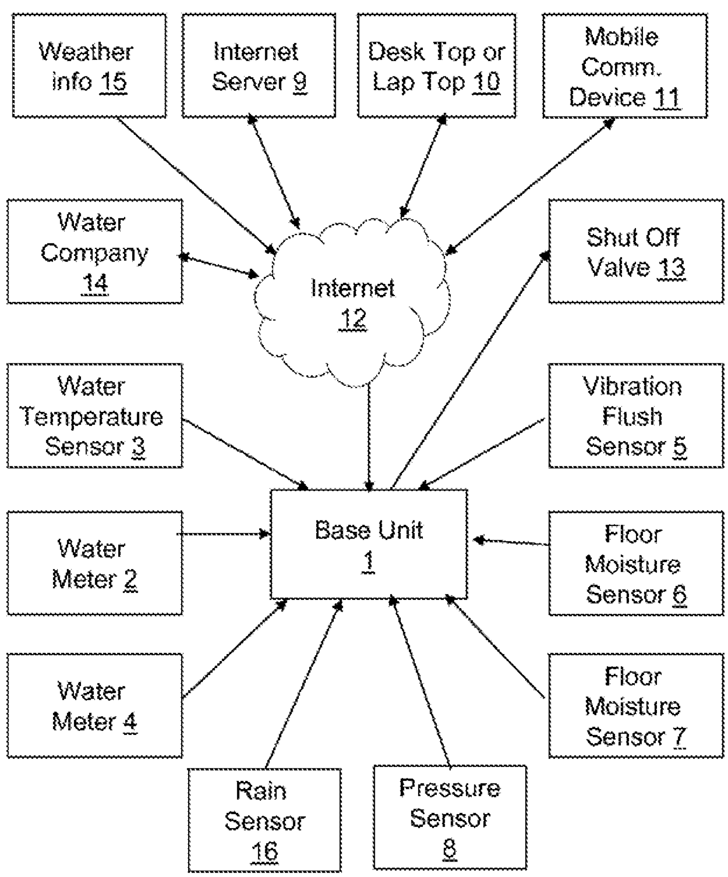
G06F 17/00 (2006.01)
G01F 1/00 (2006.01)
G01R 21/00 (2006.01)
G06F 19/00 (2011.01)
G08B 21/00 (2006.01)

(52) **U.S. Cl.** **700/283**; 705/413; 700/282; 702/45; 702/60; 340/626

(57) **ABSTRACT**

This invention is a water consumption monitoring and control system comprised of a base unit, itself comprising a display and a data entry device, a microprocessor, a communication link to water meters, pressure sensors, temperature sensors, flush toilet vibration sensors and shut-off valves. In addition the base unit has access to the Internet and can access a server which holds a database of water conservation information. This database includes watering advisories from the local government, and weather information from the weather office. The server runs an algorithm and generates control data which is sent to the base unit.



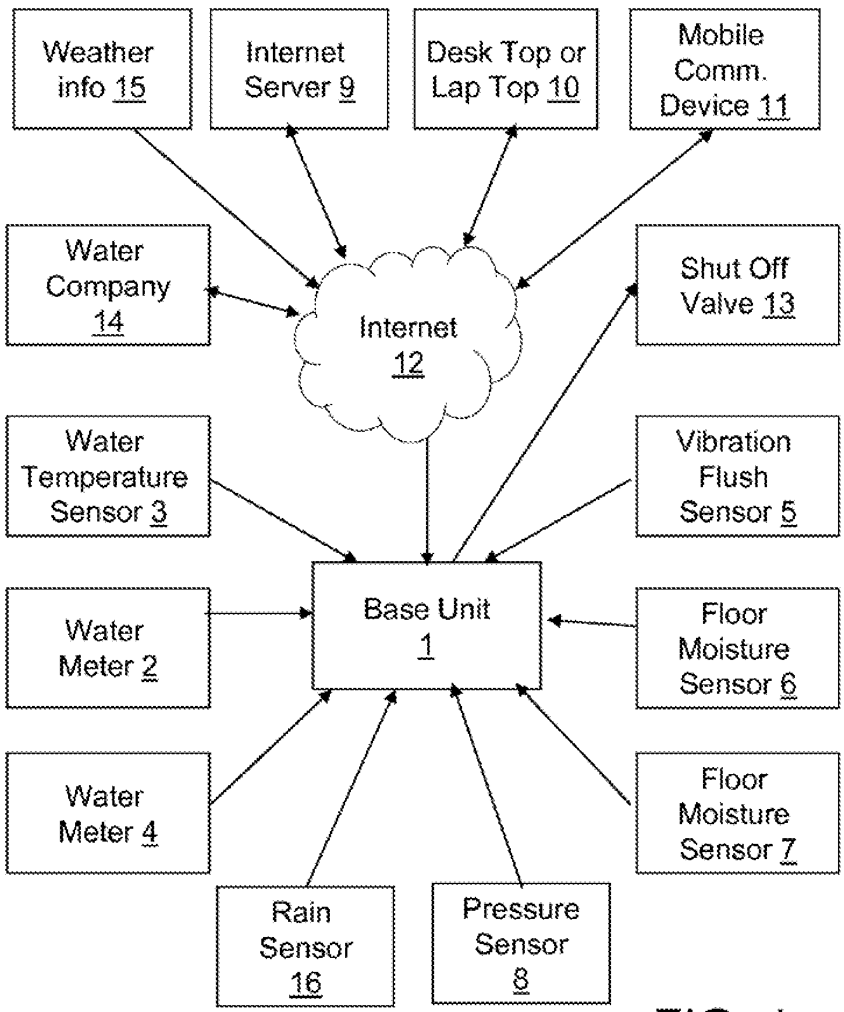

Weather info 15
Internet Server 9
Desk Top or Lap Top 10
Mobile Comm. Device 11
Water Company 14
Internet 12
Shut Off Valve 13
Water Temperature Sensor 3
Vibration Flush Sensor 5
Base Unit 1
Water Meter 2
Floor Moisture Sensor 6
Water Meter 4
Floor Moisture Sensor 7
Rain Sensor 16
Pressure Sensor 8

FIG. 1

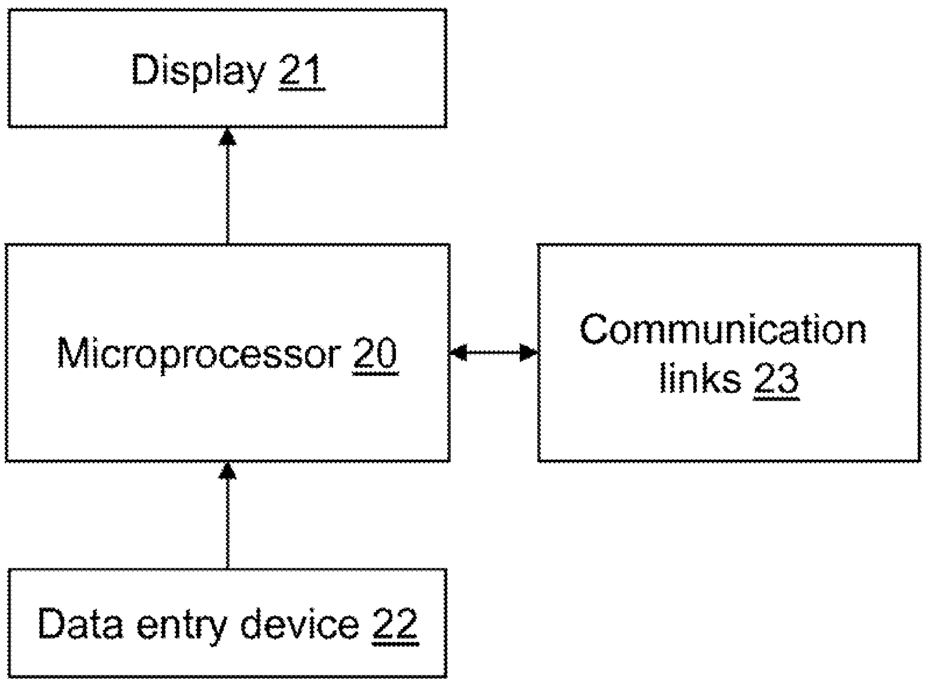

Display 21
Microprocessor 20
Communication links 23
Data entry device 22

FIG. 2

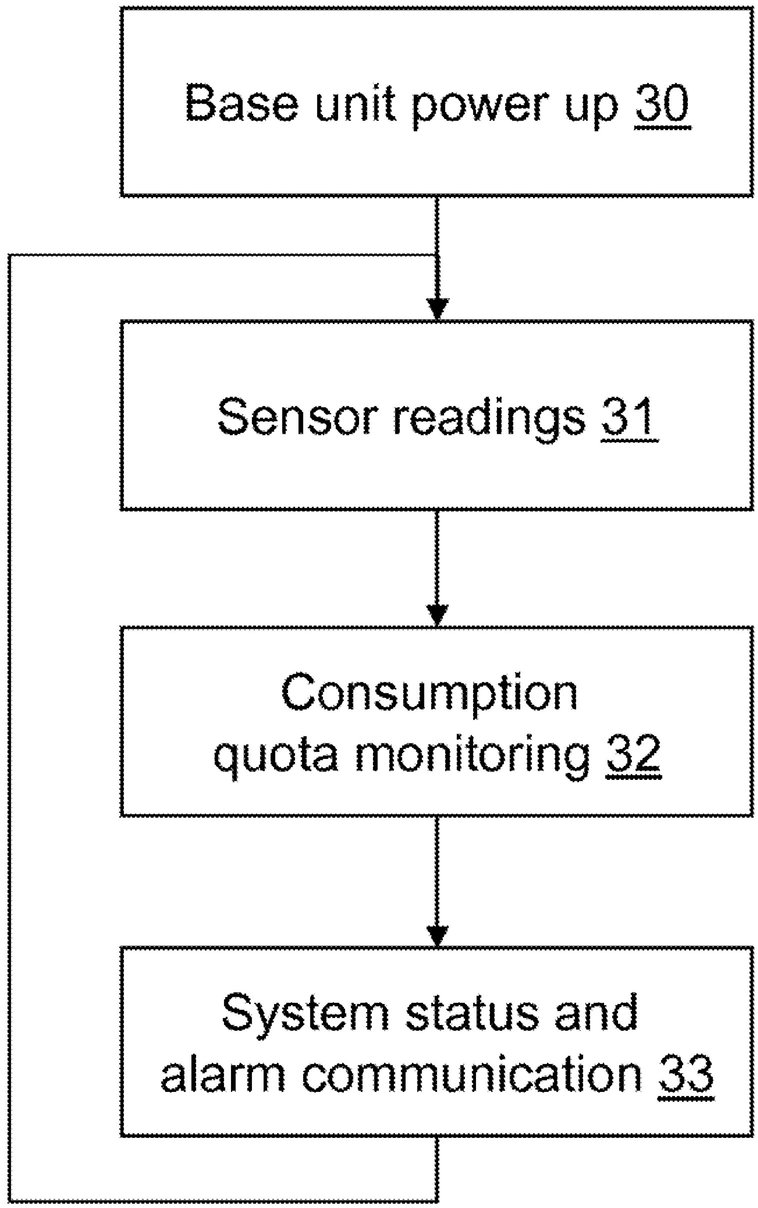

Base unit power up 30
Sensor readings 31
Consumption quota monitoring 32
System status and alarm communication 33

FIG. 3

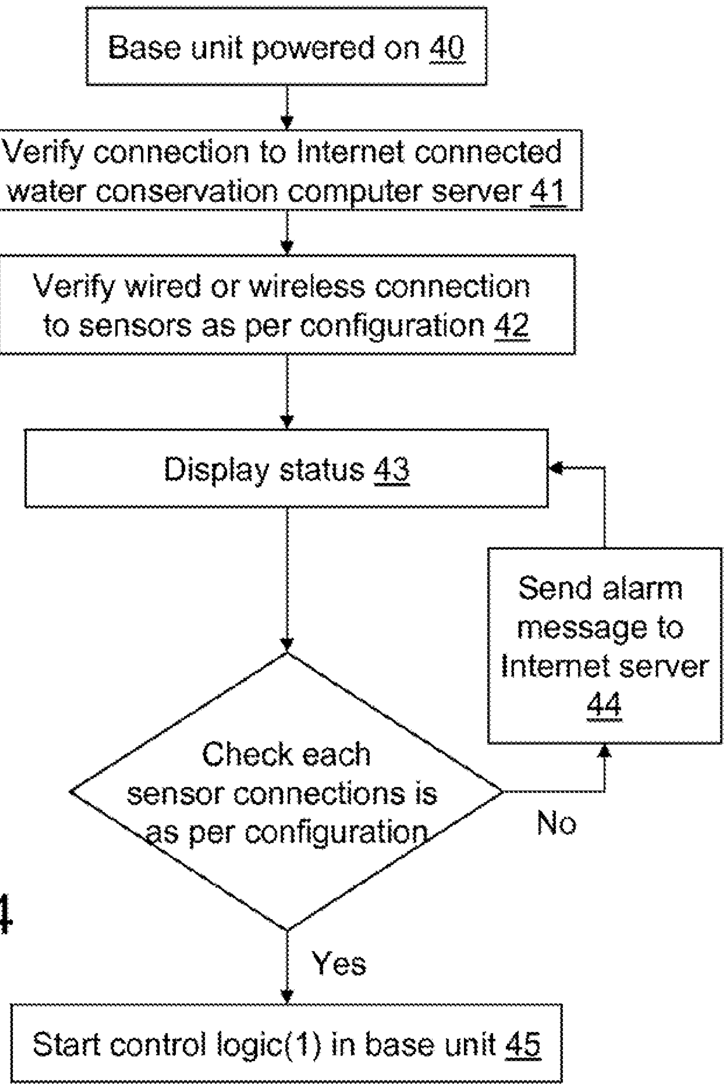

Base unit powered on 40
Verify connection to Internet connected water conservation computer server 41
Verify wired or wireless connection to sensors as per configuration 42
Display status 43
Send alarm message to Internet server 44
Check each sensor connections is as per configuration
No
Yes
Start control logic(1) in base unit 45

FIG. 4

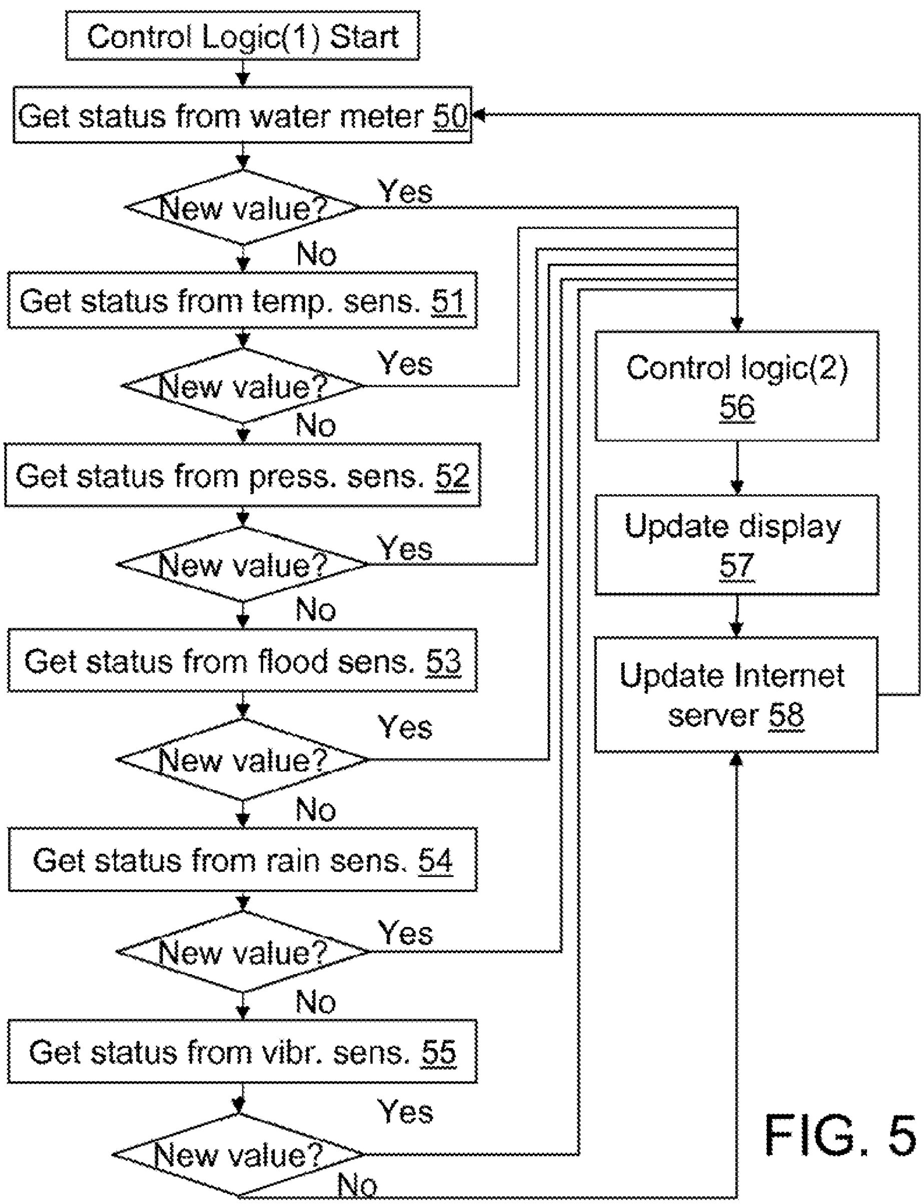

Control Logic(1) Start
Get status from water meter 50
New value?
Yes
No
Get status from temp. sens. 51
New value?
Yes
No
Get status from press. sens. 52
New value?
Yes
No
Get status from flood sens. 53
New value?
Yes
No
Get status from rain sens. 54
New value?
Yes
No
Get status from vibr. sens. 55
New value?
Yes
No
Control logic(2) 56
Update display 57
Update Internet server 58

FIG. 5

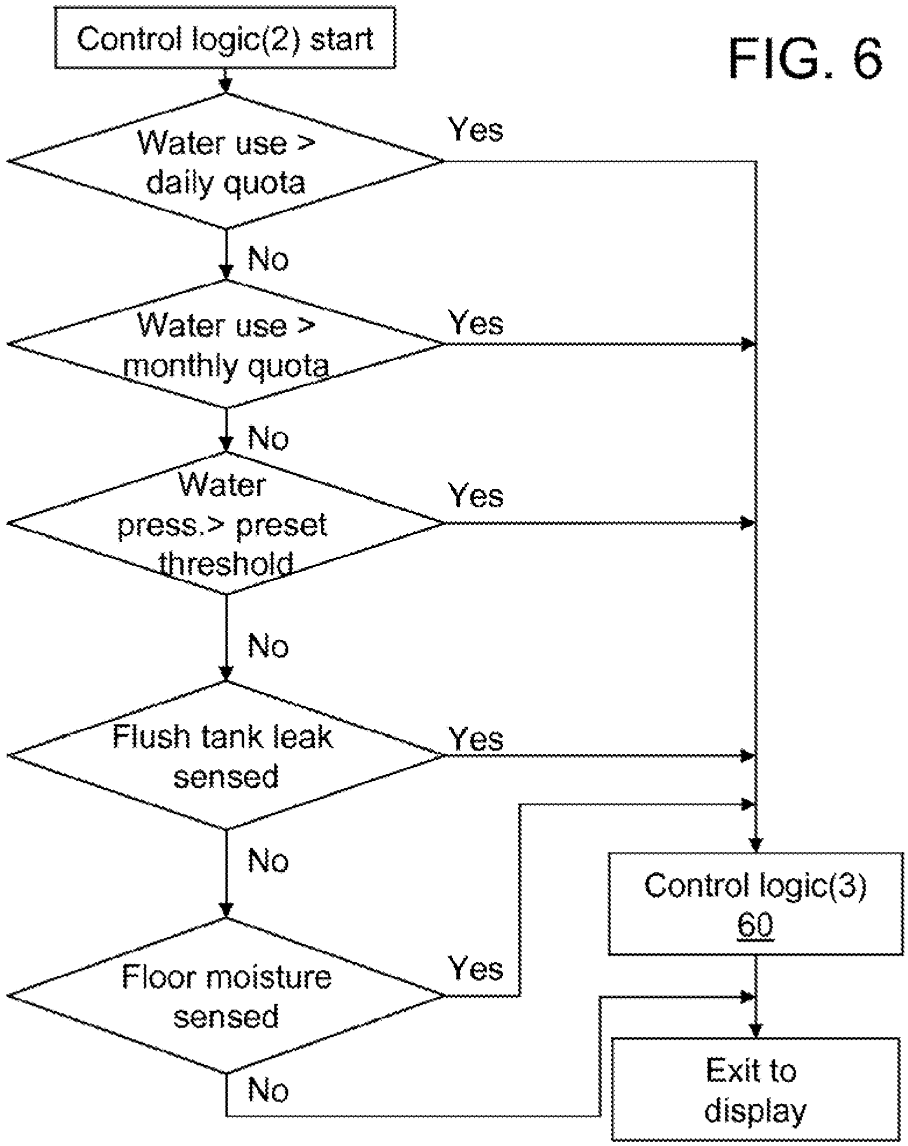

Control logic(2) start
Water use > daily quota
Yes
No
Water use > monthly quota
Yes
No
Water press.> preset threshold
Yes
No
Flush tank leak sensed
Yes
No
Floor moisture sensed
Yes
No
Control logic(3) 60
Exit to display

FIG. 6

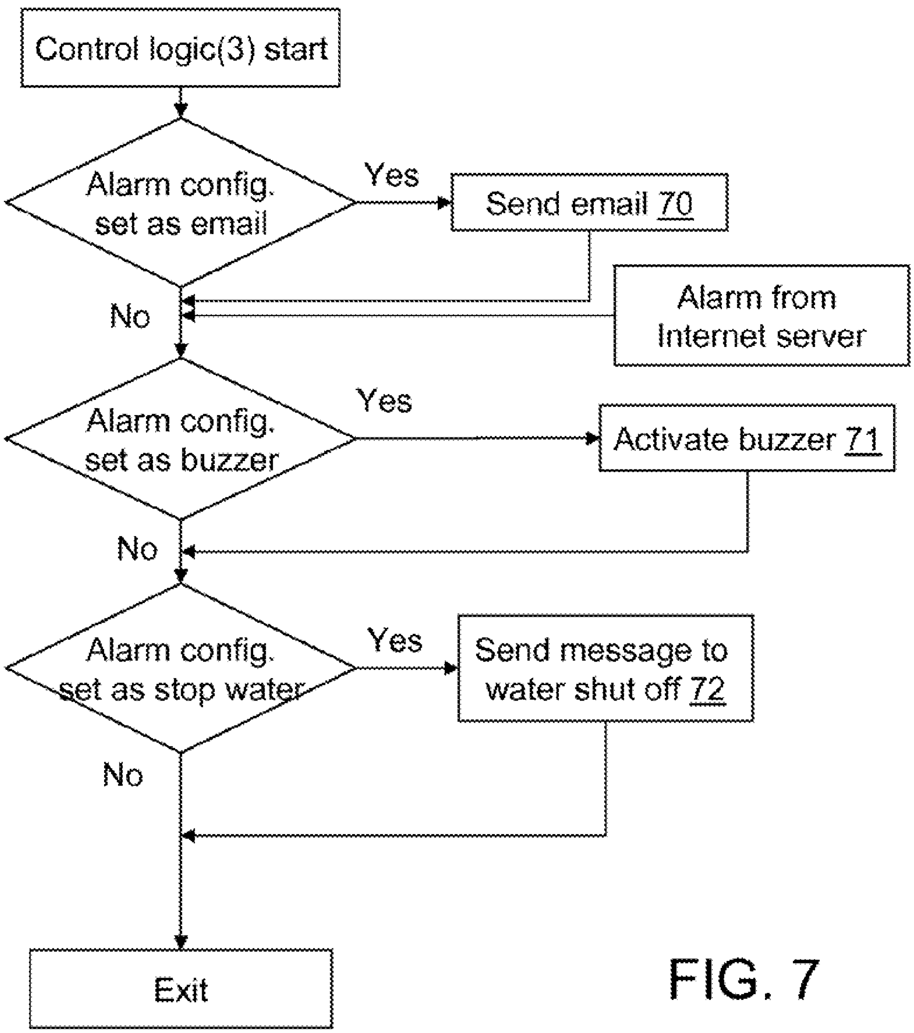

Control logic(3) start
Alarm config. set as email
Yes
Send email 70
Alarm from Internet server
No
Alarm config. set as buzzer
Yes
Activate buzzer 71
No
Alarm config. set as stop water
Yes
Send message to water shut off 72
No
Exit

FIG. 7

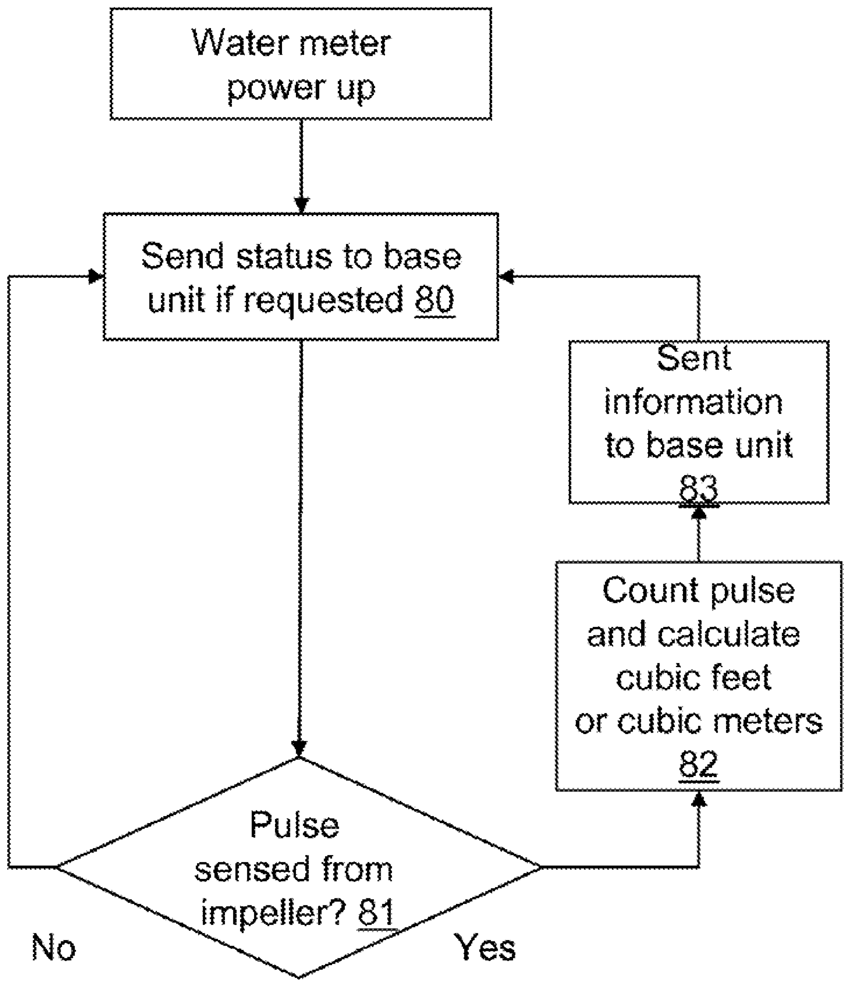

Water meter power up
Send status to base unit if requested 80
Sent information to base unit 83
Count pulse and calculate cubic feet or cubic meters 82
Pulse sensed from impeller? 81
No
Yes

FIG. 8

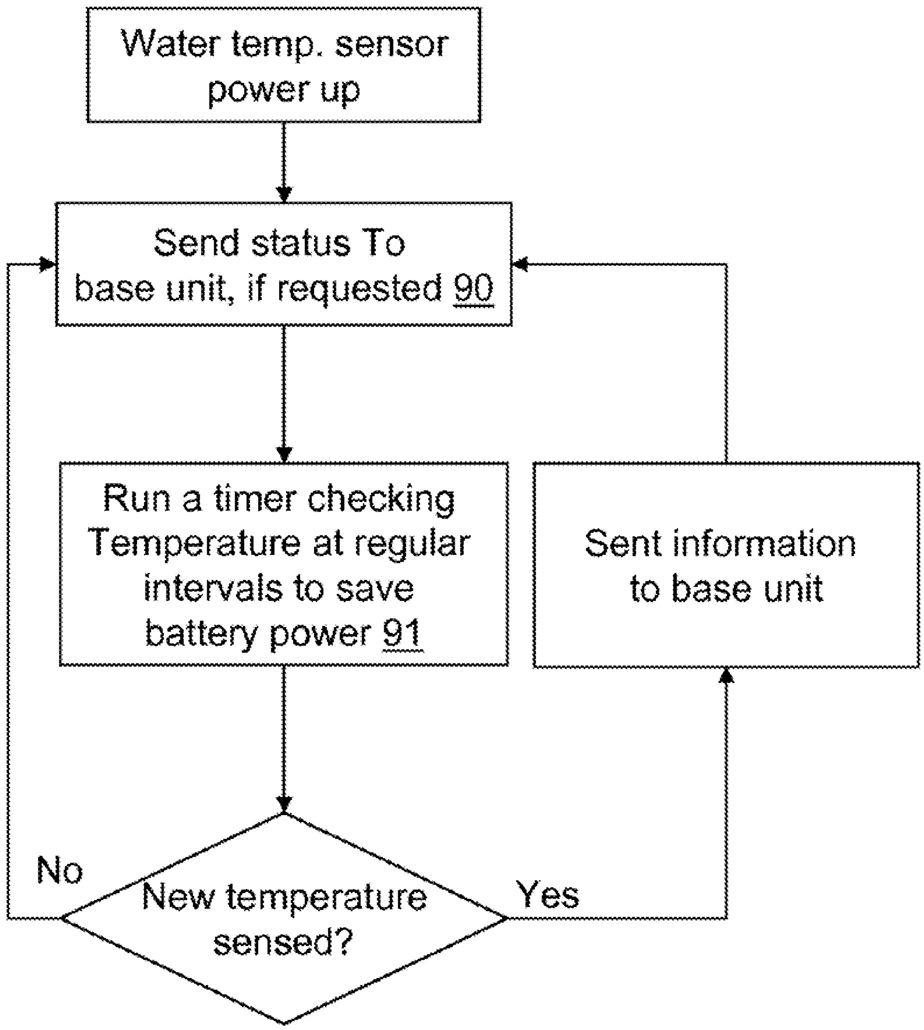

Water temp. sensor power up
Send status To base unit, if requested 90
Run a timer checking Temperature at regular intervals to save battery power 91
Sent information to base unit
New temperature sensed?
No
Yes

FIG. 9

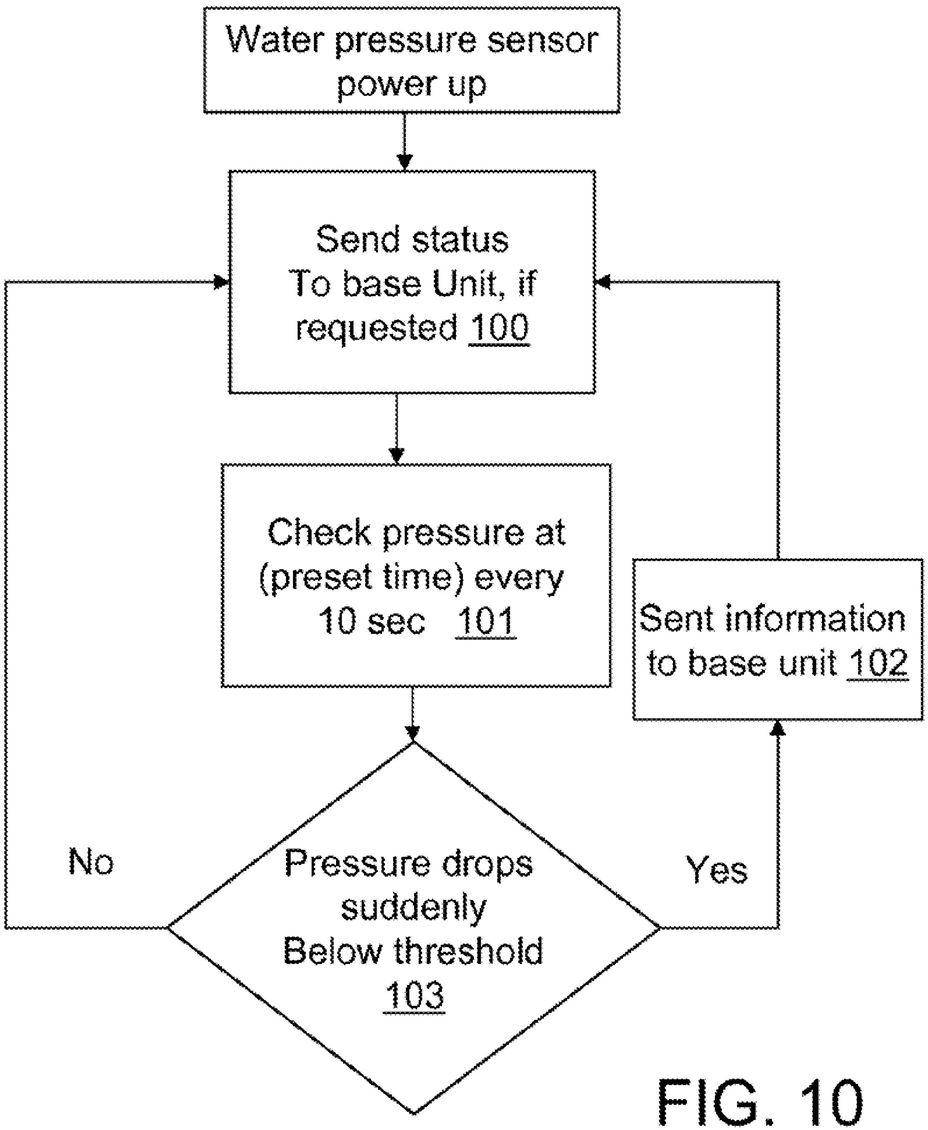

Water pressure sensor power up
Send status To base Unit, if requested 100
Check pressure at (preset time) every 10 sec 101
Pressure drops suddenly Below threshold 103
No
Yes
Sent information to base unit 102

FIG. 10

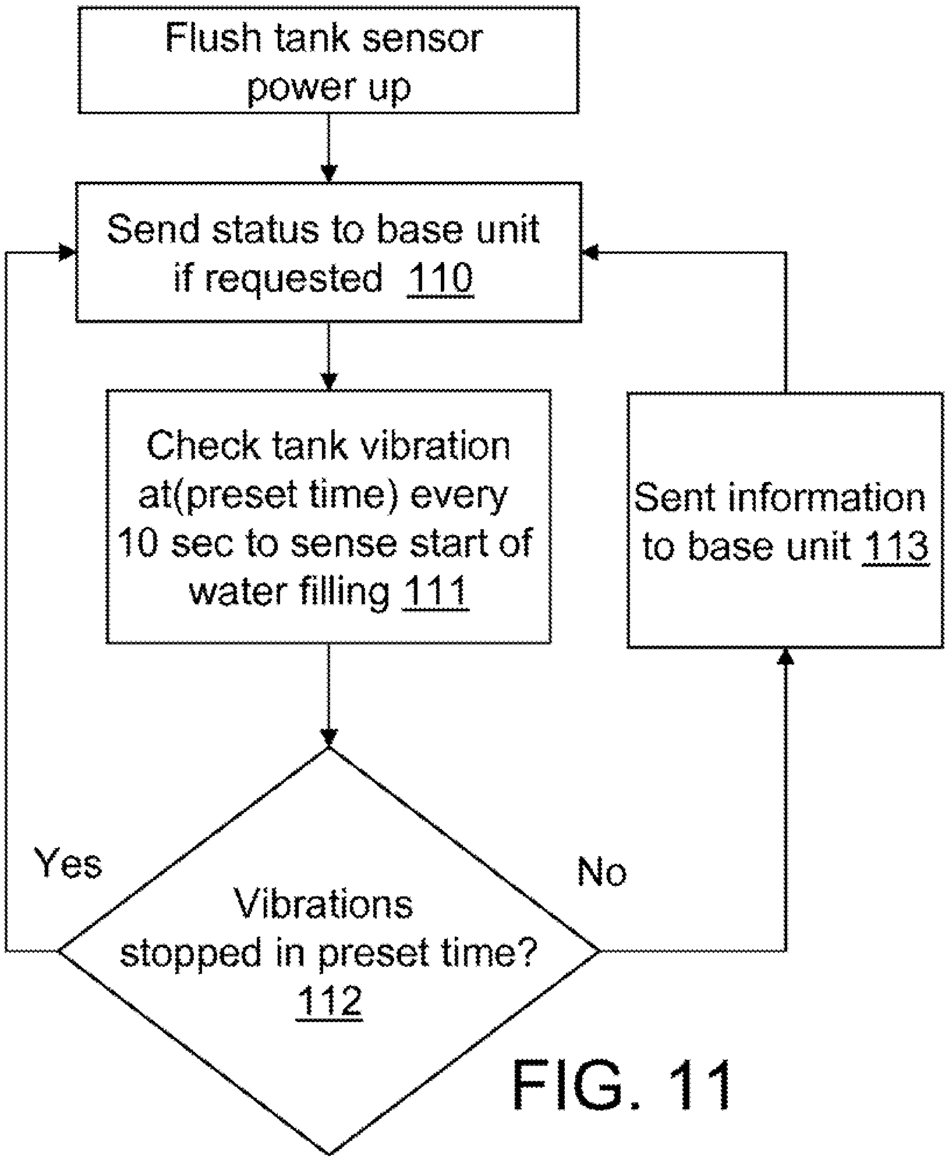

Flush tank sensor power up
Send status to base unit if requested 110
Check tank vibration at(preset time) every 10 sec to sense start of water filling 111
Sent information to base unit 113
Yes
No
Vibrations stopped in preset time? 112

FIG. 11

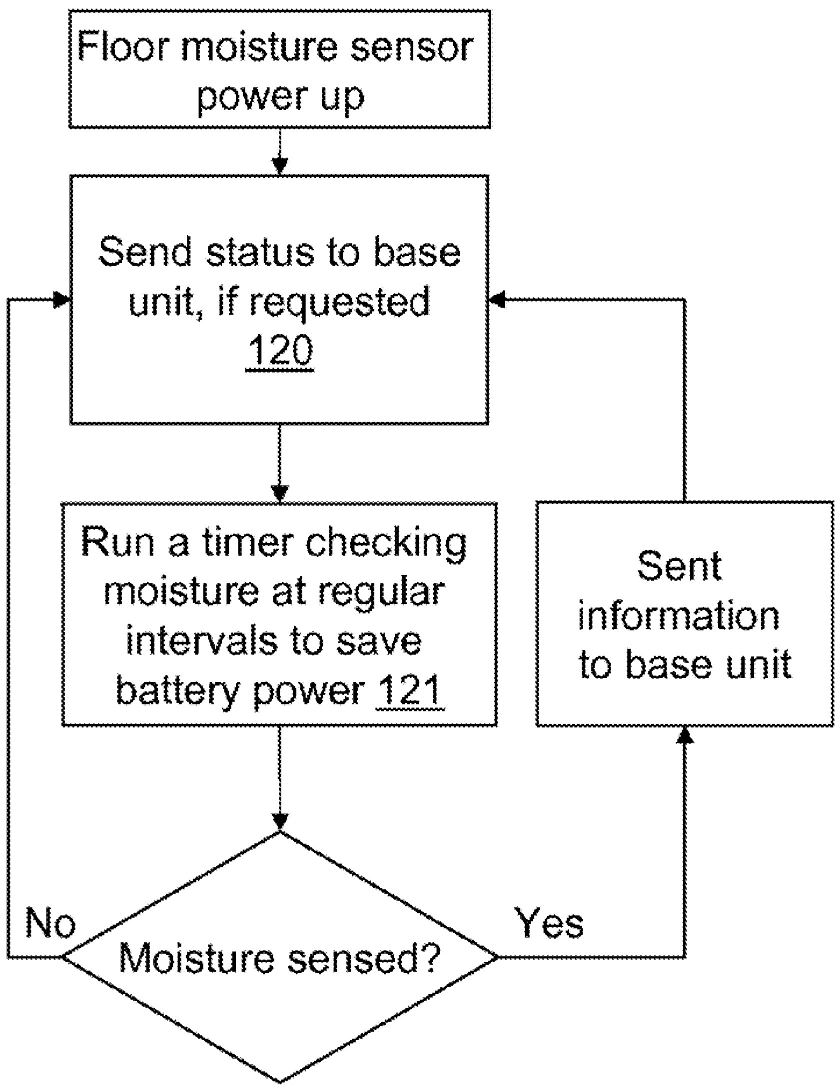

Floor moisture sensor power up
Send status to base unit, if requested 120
Run a timer checking moisture at regular intervals to save battery power 121
Sent information to base unit
No
Moisture sensed?
Yes

FIG. 12

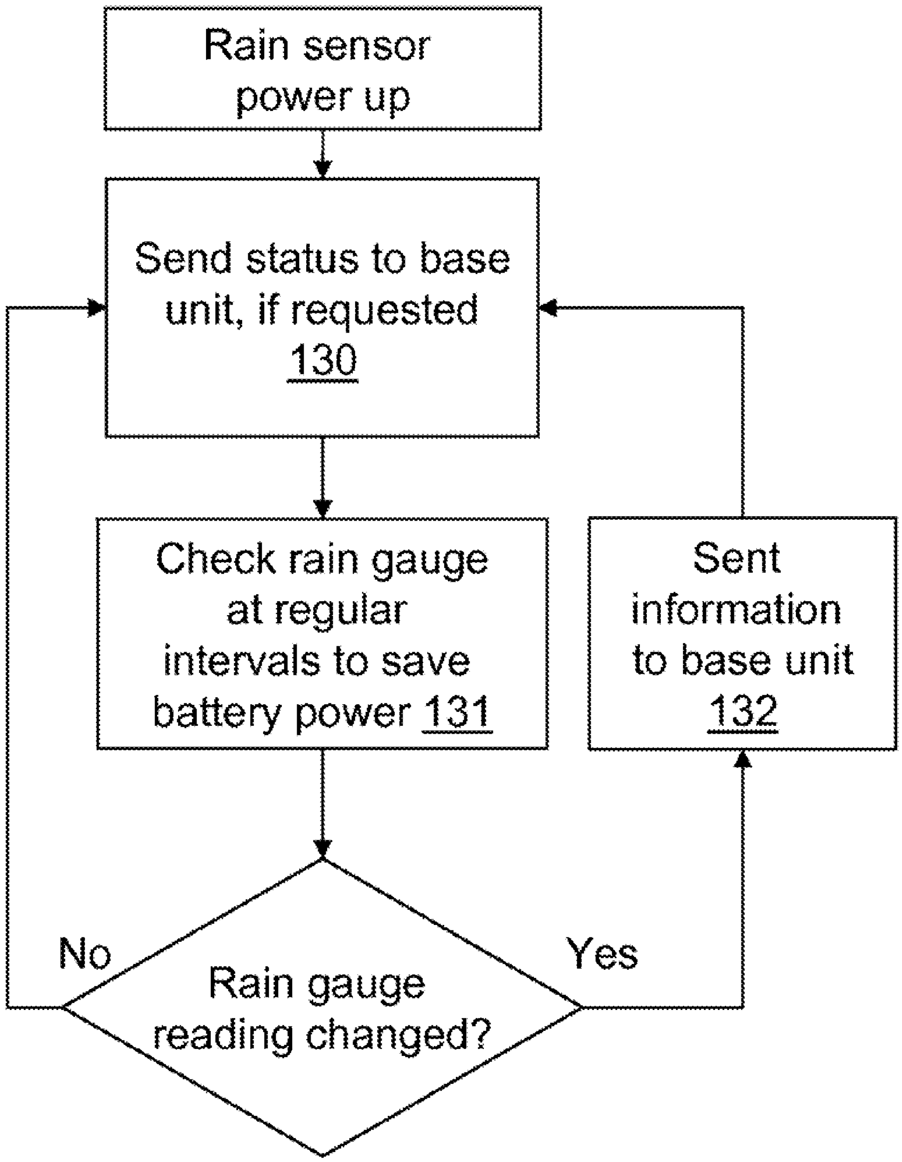

Rain sensor power up
Send status to base unit, if requested 130
Check rain gauge at regular intervals to save battery power 131
Sent information to base unit 132
Rain gauge reading changed?
No
Yes

FIG. 13

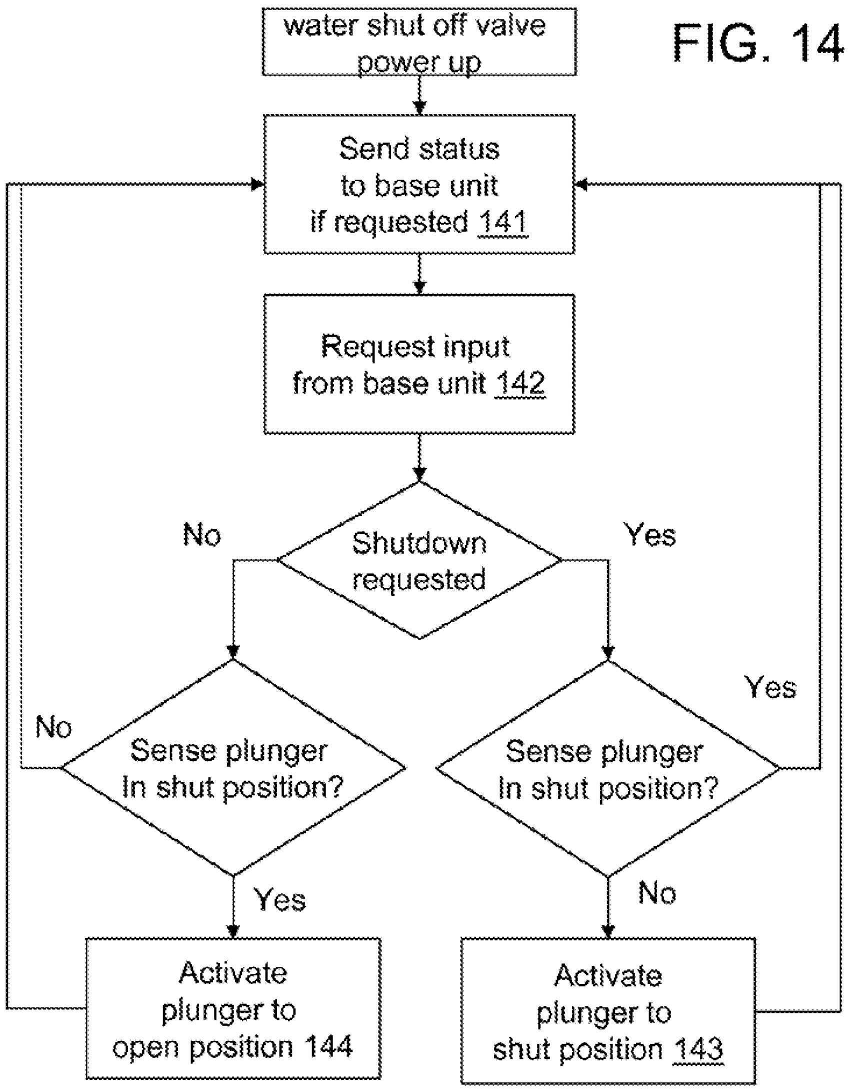

water shut off valve power up
Send status to base unit if requested 141
Request input from base unit 142
Shutdown requested
No
Yes
Sense plunger In shut position?
No
Yes
Sense plunger In shut position?
Yes
No
Activate plunger to open position 144
Activate plunger to shut position 143

FIG. 14

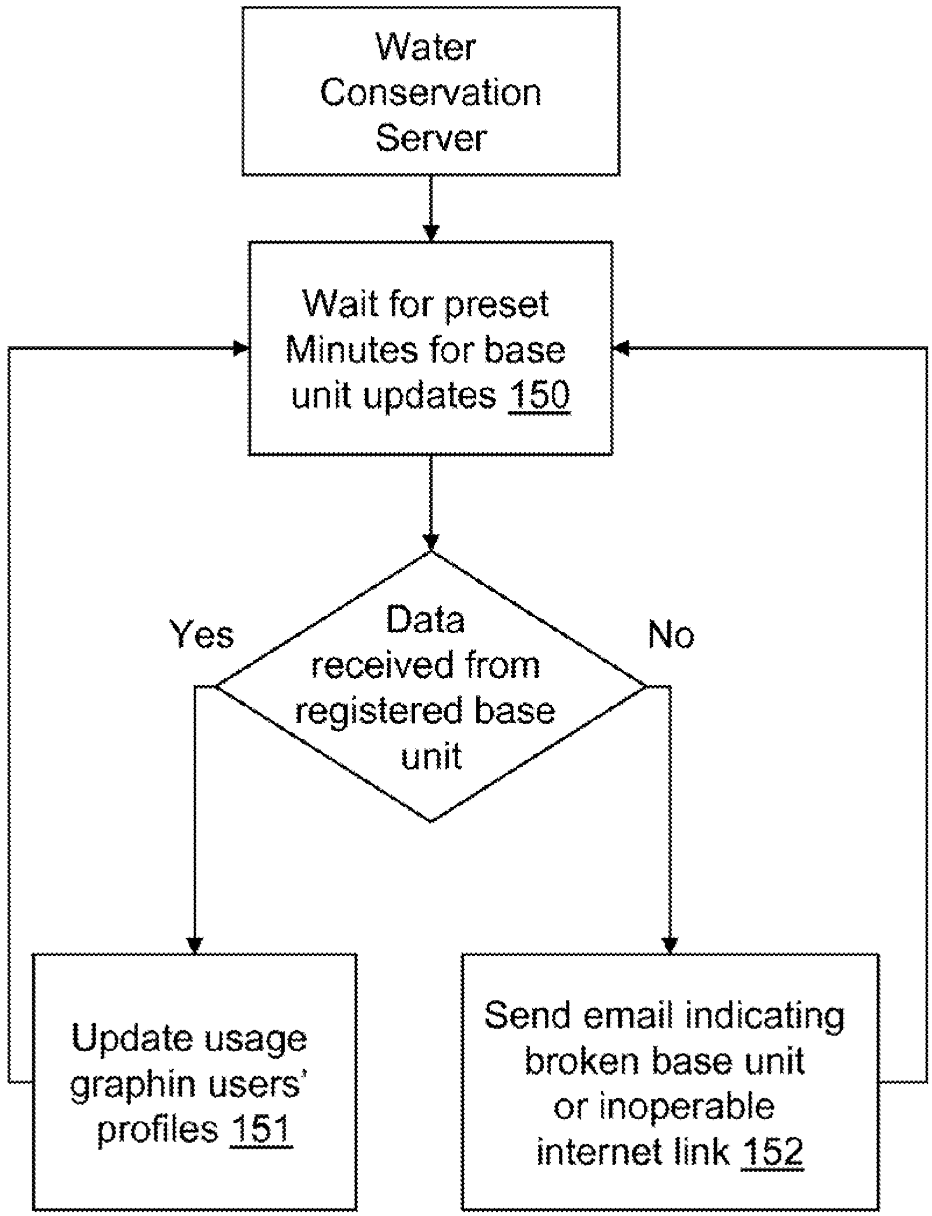

Water Conservation Server
Wait for preset Minutes for base unit updates 150
Data received from registered base unit
Yes
No
Update usage graphin users' profiles 151
Send email indicating broken base unit or inoperable internet link 152

FIG. 15

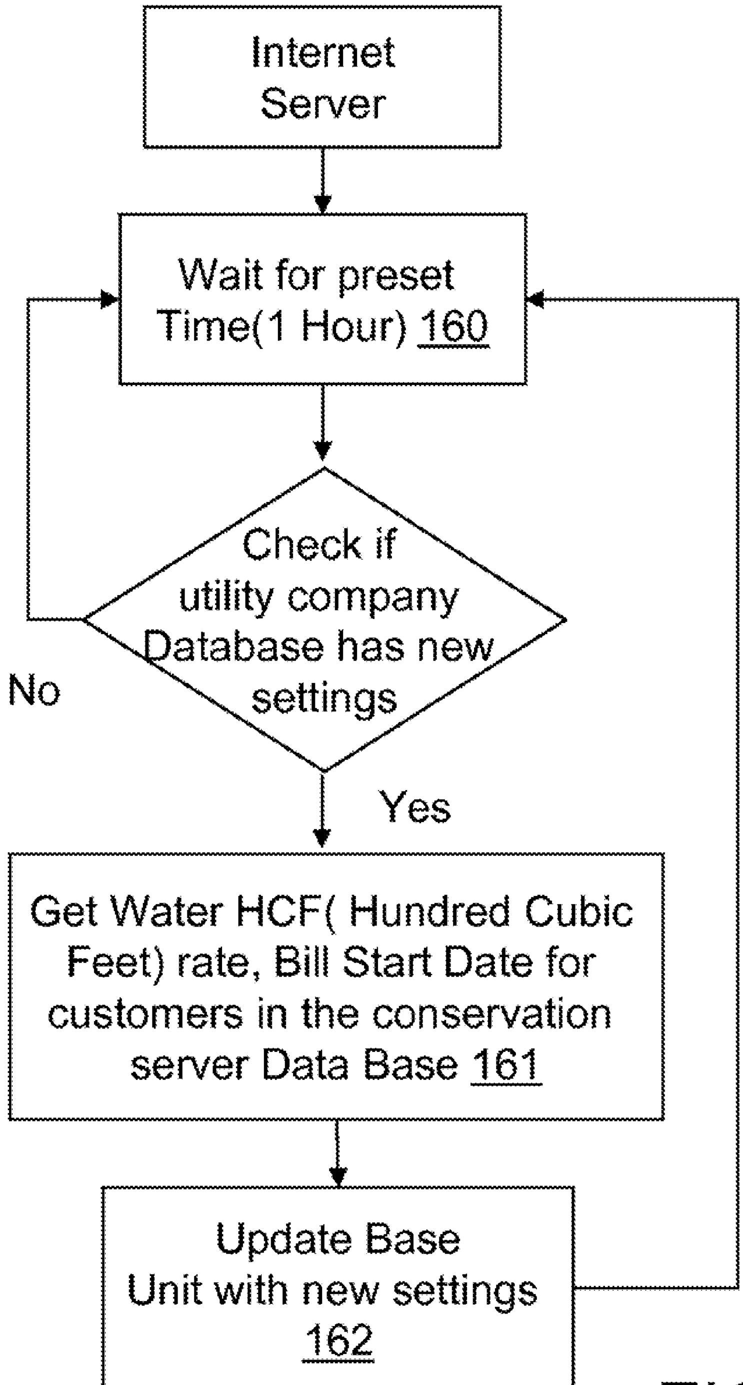

Internet Server
Wait for preset Time(1 Hour) 160
Check if utility company Database has new settings
No
Yes
Get Water HCF(Hundred Cubic Feet) rate, Bill Start Date for customers in the conservation server Data Base 161
Update Base Unit with new settings 162

FIG. 16

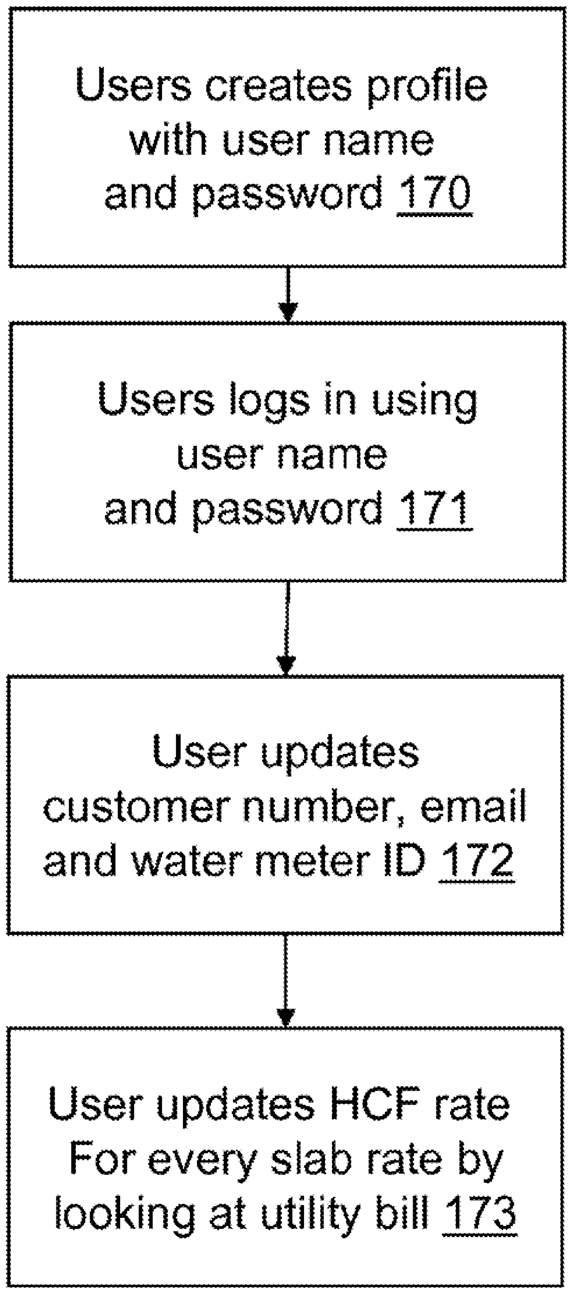

Users creates profile with user name and password 170
Users logs in using user name and password 171
User updates customer number, email and water meter ID 172
User updates HCF rate For every slab rate by looking at utility bill 173

FIG. 17

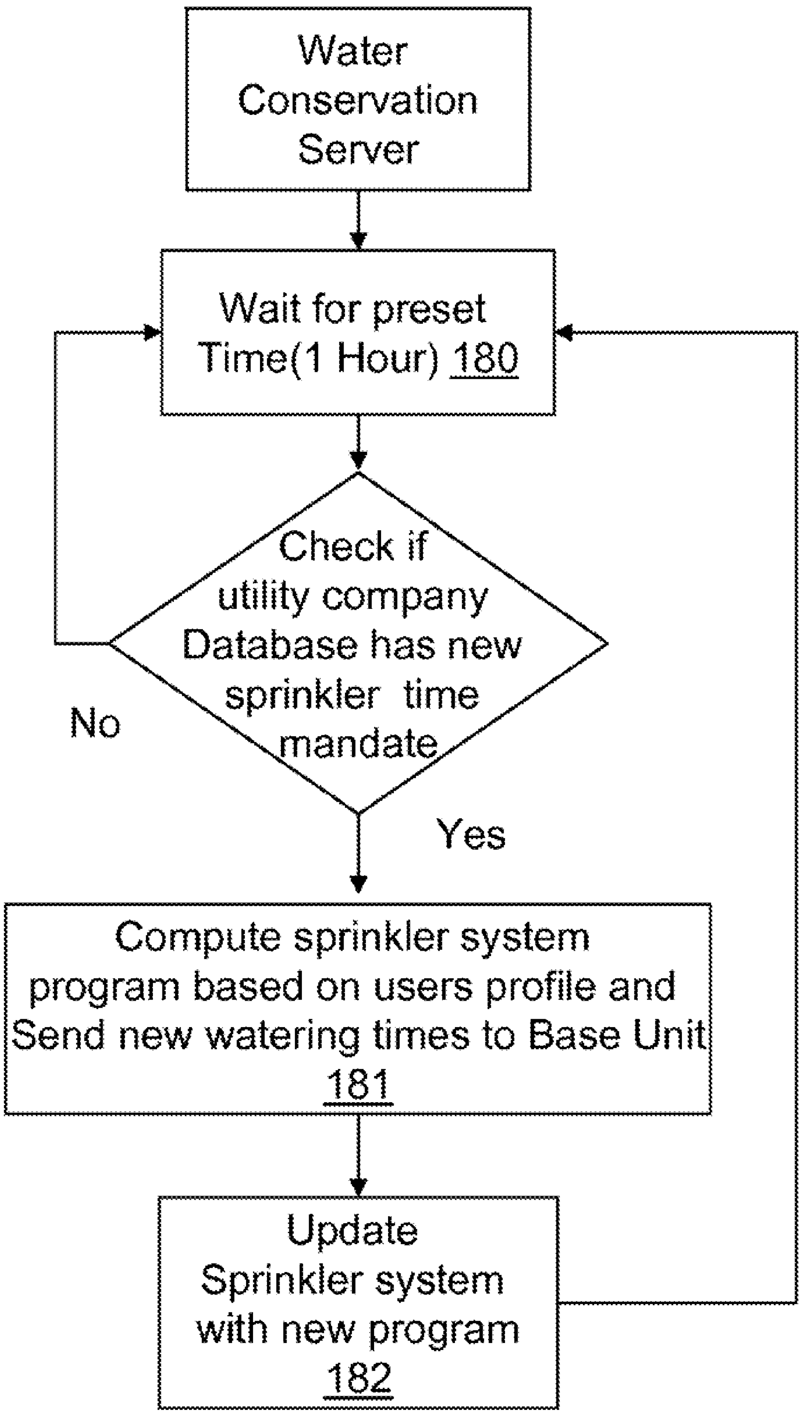

Water Conservation Server
Wait for preset Time(1 Hour) 180
Check if utility company Database has new sprinkler time mandate
No
Yes
Compute sprinkler system program based on users profile and Send new watering times to Base Unit 181
Update Sprinkler system with new program 182

FIG. 18

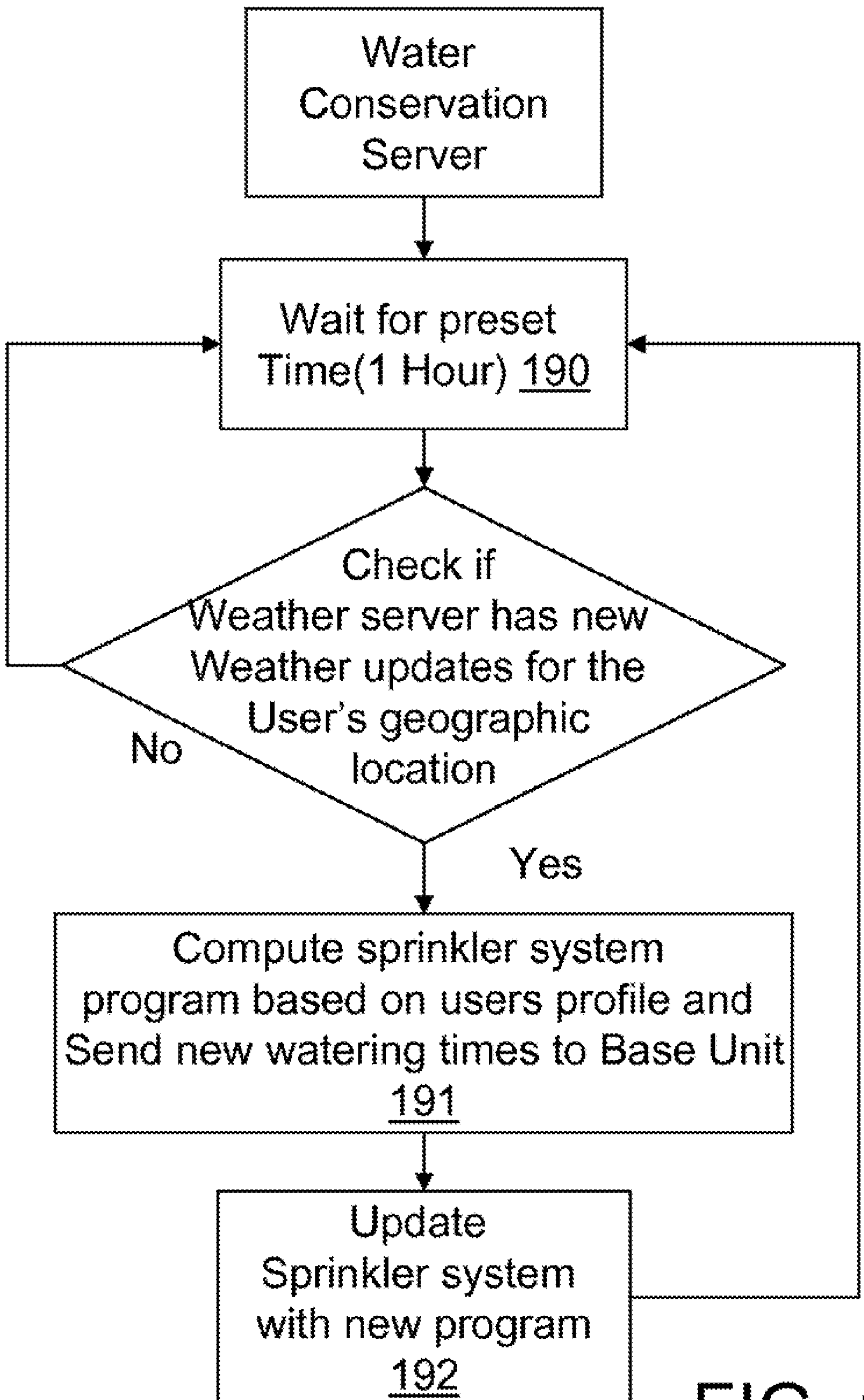

Water Conservation Server
Wait for preset Time(1 Hour) 190
Check if Weather server has new Weather updates for the User's geographic location
No
Yes
Compute sprinkler system program based on users profile and Send new watering times to Base Unit 191
Update Sprinkler system with new program 192

FIG. 19

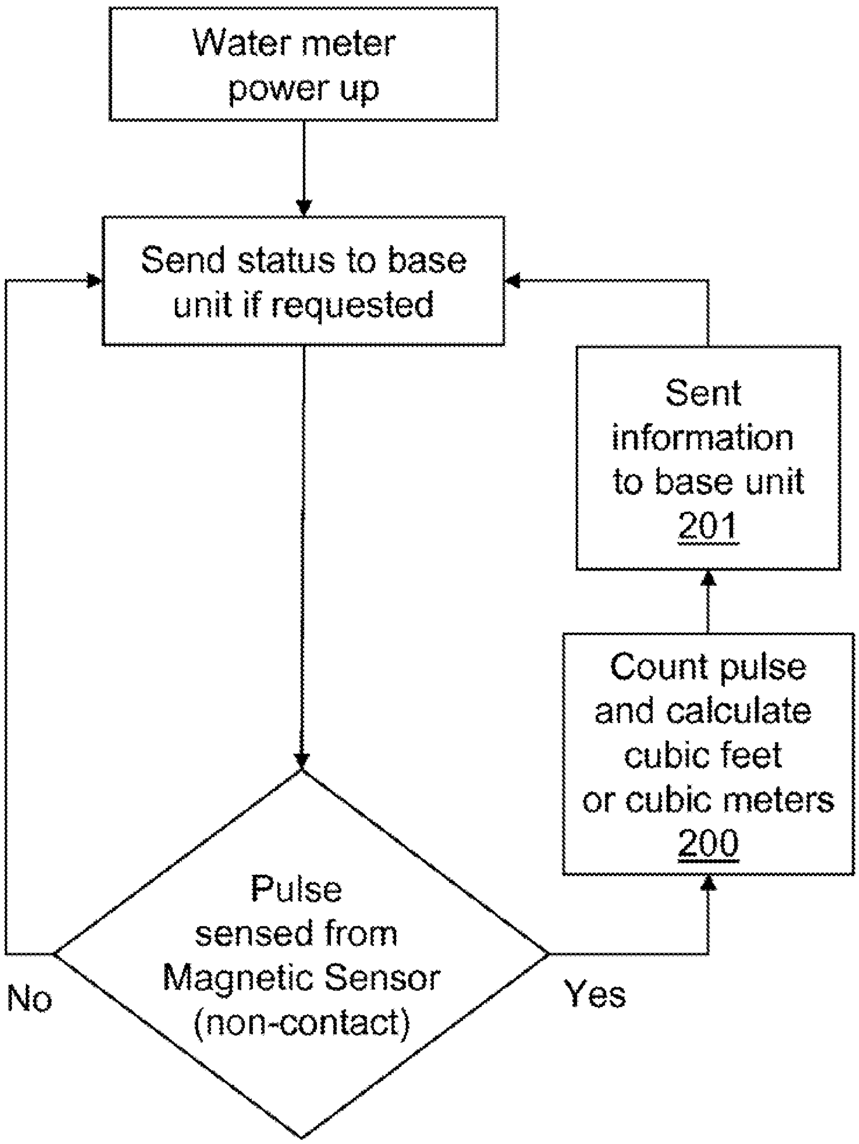

Water meter power up
Send status to base unit if requested
Sent information to base unit 201
Count pulse and calculate cubic feet or cubic meters 200
Pulse sensed from Magnetic Sensor (non-contact)
No
Yes

FIG. 20

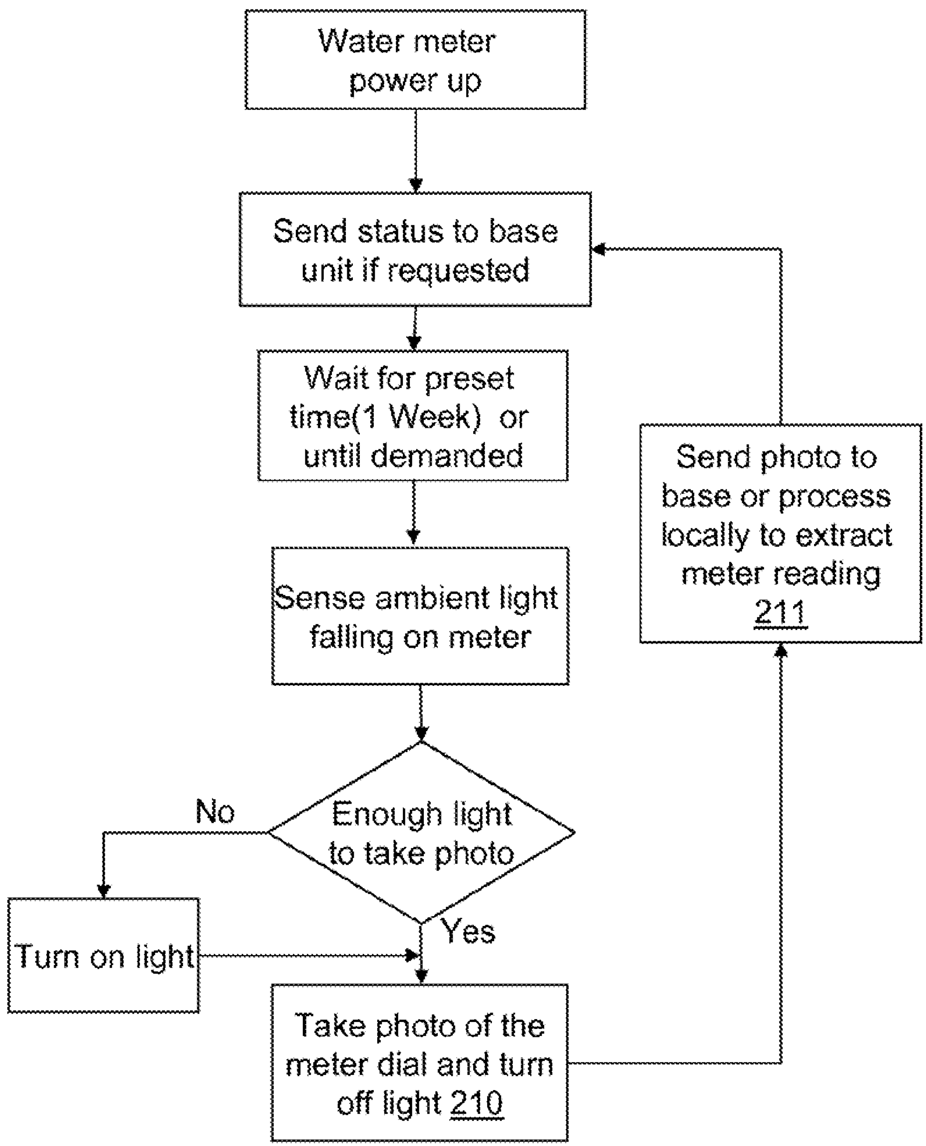

Water meter power up
Send status to base unit if requested
Wait for preset time(1 Week) or until demanded
Sense ambient light falling on meter
Enough light to take photo
No
Yes
Turn on light
Take photo of the meter dial and turn off light 210
Send photo to base or process locally to extract meter reading 211

FIG. 21

WATER MANAGEMENT SYSTEM

FIELD OF THE INVENTION

[0001] This invention claims the benefit of U.S. Provisional Applications No. 61/346,267, titled "Intelligent data logging, analysis system and/or subscription service for single and multi-site synchronous data, not limited to wind, solar analysis and water conservation applications" filed on May 19, 2010, and U.S. Provisional Applications No. 61/253,199 titled "Intelligent data logging and analysis system for single and multi-site synchronous data, not limited to wind and solar analysis applications and subscription service" filed on Oct. 20, 2009. Both of these applications are hereby incorporated by reference. Applicant claims priority pursuant to 35 U.S.C. Par 119(e)(i). The present invention relates to the monitoring and control of water consumption.

BACKGROUND

[0002] Freshwater is vital to health and to the economy, and reliable access to it is becoming increasingly important as the human population on Earth increases. Yet its availability is limited. Conservation is an important issue and therefore, water management tools are important, especially those tools that provide average households with the means for managing their own water consumption.

[0003] Many devices exist for monitoring and controlling water usage, but they provide limited functionality. For example water meters exist that allow consumers to measure their own water usage. These devices however have no time resolution or past history records. Users cannot tell exactly when water is being used and by whom. Water thermometers exist that allow consumers to measure the temperature of their hot water and indirectly the amount of energy they use for heating water. These thermometers, however, are not connected to a central control system that monitors energy usage. Water valves exist that allow users to shut off water flow but these devices are not connected to a central management system that can control their open or close status. Flood alarms exist but they are not integrated with a central water management system capable of shutting off water in case of a flood. Water pressure measurement systems exist but they are not integrated with a central management system capable of displaying pressure and of shutting off valves either in case of overpressure that could damage sprinklers or appliances, or in case of underpressure indicative of pipe breakage. Weather monitoring systems exist but are not integrated with a central water management system capable, for example of regulating lawn irrigation. Billing systems exist but they are not integrated with a central water management system. Furthermore these devices are limited in their capabilities to communicate with consumers. The Rain Bird Company is marketing a smart controller that can be used to control sprinkler time based on weather data from public weather server data. But this controller does not use water authority mandates that are put in place sometimes during droughts to change watering time into their schedules and is not integrated into a comprehensive water management system.

[0004] Current water monitoring systems only send the cumulative water flow measurement in the form of a count, every few hours. This relatively long time interval makes water consumption monitoring impossible to perform in real time.

[0005] None of the water meters have an integrated shut off value that can be activated remotely. The decision is made at the water companies to shut off water distribution.

[0006] None of the prior art offers the entertainment value of this invention. Further features, aspects, and advantages of the present invention over the prior art will be more fully understood when considered with respect to the following detailed description claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** illustrates the whole system, showing the base unit in communication with water sensors and actuators, and through the Internet, with a server, user computers, mobile devices, water companies and weather information services.

[0008] FIG. **2** provides a block diagram of the base unit which includes a microprocessor, a display, a data entry device, and a communication system.

[0009] FIG. **3** represents the functional flow diagram of the base unit.

[0010] FIG. **4** illustrates the power up sequence for the base unit.

[0011] FIG. **5** shows the functional block diagram for the sensor monitoring operation of the base unit.

[0012] FIG. **6** is a functional flow diagram of the decision process and quota utilization for the base unit.

[0013] FIG. **7** illustrates the functional flow diagram for outputting messages and alarms.

[0014] FIG. **8** shows the functional flow diagram for the operation of the water meter sensor.

[0015] FIG. **9** illustrates the functional flow diagram for the operation of the water temperature sensor.

[0016] FIG. **10** represents the functional flow diagram of the water pressure sensor.

[0017] FIG. **11** illustrates the functional flow diagram for the toilet flush sensor.

[0018] FIG. **12** shows the functional flow diagram for the floor moisture sensor used to detect floods.

[0019] FIG. **13** provides the flow diagram of the operation of a rain sensor.

[0020] FIG. **14** illustrates the functional flow diagram for the shut off valve actuator.

[0021] FIG. **15** shows the communication of the Internet server with each base unit.

[0022] FIG. **16** illustrates how the Internet server collects cost data from a water utility company and updates the base units according to this data.

[0023] FIG. **17** shows how the Internet server updates the user profile, water meter profile, and utility rates and water rates.

[0024] FIG. **18** illustrates how the Internet server collects mandated watering times from a water utility company and updates the base units and sprinklers according to this data

[0025] FIG. **19** illustrates how the Internet server collects weather data and updates the base units and sprinklers according to this data.

[0026] FIG. **20** illustrates how the fluctuating magnetic field near a water meter can be used to extract water usage information.

[0027] FIG. **21** shows how an optical technique can be used to read a water meter and extract water usage information.

SUMMARY OF THE INVENTION

[0028] This invention is a water consumption monitoring and control system that allows a user to monitor and control water consumption. It is comprised of a base unit which itself comprises

[0029] a) a display and a data entry device;

[0030] b) a microprocessor

[0031] c) a communication link connected to a water meter, through which water usage information is transmitted to the base unit.

[0032] d) a second communication link to the Internet through which a user can monitor and control his water usage. The water usage can be converted to a dollar amount for the benefit of the user.

[0033] The water consumption monitoring and control system is also connected to pressure sensors. The received pressure information is compared to pre-entered criteria. An alarm is generated if the pressure information does not conform to the pre-entered criteria. For example, a low pressure may indicate breakage or leak in a water pipe. This alarm is used to generate a message over the Internet in the form of email, tweet or text. Text messaging could use, for example, the Short Message Service (SMS) protocol.

[0034] The water consumption monitoring and control system is also connected to water shut-off valves. The received pressure information is compared with pre-entered criteria. A shut-off signal is generated if the pressure information does not conform to the pre-entered criteria. This shut-off signal is sent to the shut-off valves.

[0035] Communication is established over the Internet with the local water utility company. Water usage and pressure information is sent to the company which compares this data against pre-set usage and pressure criteria and sends shut-off command signals to the base unit if the information does not conform to the pre-set usage and pressure criteria. This shut off signal is forwarded to the shut-off valves. Possible reasons for shutting off the water supply is that the utility company may determine that the water is unsafe to drink or that customers have not paid their bills.

[0036] Communication is established over the Internet between the base unit and an Internet server. Water usage and pressure data are sent to the server which evaluates this information and returns usage control information to the base unit.

[0037] Water schedule advisories are received over the Internet from the local government water department. This data is used by the Internet server to generate government advisory control information which is sent to the base unit.

[0038] Weather information is received over the Internet from the weather office. This data is used by the Internet server to generate weather advisory control information which is sent to the base unit.

[0039] The base unit is also connected to, and can control the operation of, a sprinkler system.

[0040] Water temperature information is also transmitted to the base unit and used to calculate the energy used in heating water.

[0041] Floor moisture sensors that generate information regarding the absence or presence of a flood are also linked to the base unit. In the presence of a flood, an alarm is generated and an Internet message is sent to the user.

[0042] The base unit is also connected to vibration sensors configured to detect the vibrations produced by flushing toilets. Malfunctioning toilets which may take too long to fill can thus be identified.

[0043] The base unit can also be connected to several water meters, each water meter located in a different housing or commercial unit, thereby allowing the user (for example the landlord) to monitor the tenant's usage. Similarly the base unit can monitor water usage at different points within a single house.

[0044] The microprocessor in the base unit can record water usage as well as pressure and temperature information over a period of time and use this historical information to detect water wastage and to detect leaks and pipe breakage.

[0045] The base unit can also provide to the user the information regarding the water consumption of his neighbors (or user defined groups anywhere in the world like families, brother and sisters, college campus or special interest groups) and his rank in water usage, thereby stimulating water conservation through competitive thinking.

DETAILED DESCRIPTION

[0046] The system block diagram of the invention is shown in FIG. **1**. It comprises the following components:

[0047] a) A display/control panel called the base unit. **1**

[0048] b) A series of sensors including water temperature sensors **3**, water pressure sensors **8**, floor moisture sensors **7**, vibration flush sensors **5**, water meters **2**, **4**, rain sensors/gauge **16**.

[0049] c) A series of actuators, such as shut off valves **13**.

[0050] d) Communication links to several entities located on the Web in particular a server **9**, a utility company **14** (water company), a weather information service **15** and user mobile communication devices (e.g., cell phones)

[0051] e) An internet server **9**

[0052] f) Desk top or lap top computers **10**

[0053] g) User mobile communication devices **11**

[0054] The base unit **1** is configured to monitor and control water consumption. The block diagram of the base unit is shown in FIG. **2**. It comprises a microcontroller **21**, a display **21**, a data entry device **22** and at least one commmication link **23**.

[0055] The communication links **23** can include communication from the sensors to the actuators. This communication can be implemented by means of a wire or wirelessly for example, by means of ISM band transceivers, Zigbee or WiFi. The communication also includes access to the Internet, either wirelessly, or by means of a wired ethernet.

[0056] The overall operation of the microcontroller **20** is illustrated in the flow diagrams provided in FIG. **3**. It includes

[0057] a) a power up sequence **30**,

[0058] b) inputting sensor data **31**,

[0059] c) quota evaluation and monitoring **32**, and

[0060] d) outputting system status and alarm data **33**.

[0061] The power up sequence **30** is illustrated in detail in FIG. **4**. It includes the following:

[0062] a) powering up **40** the base unit **1**,

[0063] b) verifying **41** that the connection to the water conservation server on the Internet is working,

[0064] c) verifying **42** that the wired or wireless connections to the sensors and actuators are operational,

[0065] d) displaying **43** the status of the system,

[0066] e) sending an alarm **44** in case of system failure,

[0067] f) starting the Control Logic (1) software **45** which inputs sensor data and monitors sensor operation. This software is shown in greater detail in FIG. **5**.

[0068] Inputting software data and monitoring software operation performed by Control Logic (1) **45** is shown in detail in FIG. **5**. Data is received from flow sensors (water meters) **50**, temperature sensors **51**, pressure sensors **52**, flood sensors **53**, rain sensors/gauge **54**, and vibration sensors **55**. If this information has changed, the Control Logic (2) software **56** is invoked, the display is updated **57**, and the Internet server is also updated **58**.

[0069] The Control Logic (2) software is illustrated in detail in FIG. **6**. The collected sensor data is compared against a set of quotas, limits or decision paradigms entered by the user or received from the server through the Internet. For example, a quota could be a daily threshold, or a monthly allowance for water usage, not to be exceeded. A decision paradigm could be a low level flow over a long period of time, which may indicate a leak in a faucet, toilet or other appliance. A decision paradigm could also be an overall low water consumption level worthy of signaling to the users as a sign that they are saving water. If a quota is exceeded or if a decision paradigm is triggered, the next step of the process as embodied in Control Logic (3) **60** is invoked.

[0070] Control Logic (3) is shown in detail in FIG. **7**. Depending on the alarm configuration as set up by the user different actions are undertaken. For example, an email, SMS or twitter messages can be sent **70** over the internet, a buzzer can be activated **71** or a water valve can be shut off **72**.

[0071] Each component of the system, peripheral to the base unit **1** is equipped with the link necessary to communicate with the base unit **1**. For example, the operation of the water meter **2**, **4** is shown in FIG. **8**. Upon powering up, the water meter performs the following cycle.

[0072] a) It sends status information to the base unit **1** if requested **80**.

[0073] b) It measures the water flow **81**.

[0074] c) It calculates the flow from count pulse and converts this flow to cubic feet or cubic meters **82**. Then it sends **83** this information to the base unit.

[0075] Another sensor of interest is the water temperature sensor **3** which indirectly indicates the amount of energy spent in heating water. The flow diagram for this sensor is shown in FIG. **9**. Upon powering up, the sensor status is sent to the base unit **1** if requested **90**. To save power, the temperature is sampled **91** at time intervals as instructed by the base unit **1**. If a new temperature is detected this information is sent to the base unit **1**.

[0076] The water pressure sensor **8** is important because overpressure may damage the piping system, and appliances such as refrigerators, ice makers, and washing machines. High pressure can also damage low pressure drip irrigation often used in residential yards. The detailed operation of the pressure sensor **8** is shown in FIG. **10**. Upon powering up, the sensor sends **100** its status to the base unit **1** if requested. To save power, the pressure is sampled **101** at time intervals as instructed by the base unit **1** and this information is sent **102** to the base unit **1**. Optionally the pressure can be compared **103** to a preset threshold and send to the base unit **1** if it exceeds the threshold. Pressure monitoring is valuable in the detection of broken pipes in water lines, in particular in sprinkler systems.

[0077] The flush tank sensor **5** can be implemented in many possible ways. For example it can sense the water lever in the tank. A preferred implementation is for this sensor to sense the vibration in the water line produced by the tank filling. The detailed operation of the flush tank sensor **5** is illustrated in FIG. **11**. Upon power up, the sensor sends **110** its status to the base unit. To save power, it measures vibrations at preset time intervals as instructed by the base unit **1** to sense the onset of water filling **111**. If the vibrations do not stop **112** after a preset time (for example 5 minutes) it sends **113** this information to the base unit as this situation may indicate a malfunction of the flushing system.

[0078] The floor moisture sensor **7** is important to detect flooding. It operation is shown in FIG. **12**. Upon power up, it sends **120** its status to the base unit. To save power, it samples **121** the floor moisture at preset time intervals as instructed by the base unit **1** and sends this information to the base unit **1**.

[0079] The rain sensor/gauge **16** measures rain and allows adjustment of the irrigation schedule. It operation is shown in FIG. **13**. Upon power up, it sends **130** its status to the base unit. To save power, it reads **131** the gauge at preset time intervals as instructed by the base unit **1** and sends this information to the base unit **1**.

[0080] The shut off valve turns off water if one of the decision paradigms is met. For example, when excessive water usage has occurred over a given period of time. As illustrated in FIG. **14**, upon power up, this actuator sends its status to the base unit. If a shut down is requested **142** and if the valve is in an open state, the actuator activates the valve to shut off **143** the water. Otherwise, if the valve is in a closed state it activates the valve to remain open **144** and maintain the water flowing.

[0081] Additional processing can be performed either at the Internet server or at the base unit. For example the energy consumed for heating water can be calculated by measuring the cold and hot water temperature and the hot water flow. This energy can be displayed in energy units (for example Watts or BTUs) or in dollars if an appropriate conversion factor is entered into the device.

[0082] As illustrated in FIG. **1** the base unit **1** communicates with an Internet server **9**. Details of this interaction are presented in FIGS. **15**, **16** and **17**.

[0083] FIG. **15** shows the communication between the Internet server **9** and one of the base units **1**. The server waits **150** for the base unit **1** to communicate. If the server **9** receives new information, this information is incorporated into the user profile database. For example, the water usage graph could be updated **151**. If the server **9** does not receive any message for a period exceeding a preset value, for example 15 minutes, an email is sent **152** to the user to notify him that the communication link with the server is inoperative or that the base unit is not functioning.

[0084] As shown in FIG. **1**, the Internet server **9** also communicates with the water utility company server **14**. This interaction at the Internet server **9** is illustrated in greater detail in FIG. **16**. The Internet server checks **160** if the utility company has any new data affecting the utilization, availability and cost of the utility (water). The server performs this action at preset time intervals (for example one hour). In particular, it updates **161** the utility rate (typically measured in hundred cubic feet—HCF) and the bill start date.

[0085] As illustrated in FIG. **17**, the Internet server **9** also allows users to create **170** a profile, and to log in **171** with a user name and password. The user can enter, or update **172** his customer number, email address, and water meter ID. The user can also enter or update **173** his usage and the cost

schedule used by the utility company. For example, water companies charge a lower rate for the first water quota (for example $3 for the first HCF) and then a higher rate if the user exceed that quota and even more for the next quota. These quotas of HCFs are also called first slab, second slab etc.

[0086] The base unit gets billing information from the water utility company to display water usage in dollars. Alternatively this billing information can be manually entered by the user.

[0087] Similarly the Internet server can get mandated watering time for irrigation sprinklers from the utility company. As shown in FIG. **18**, the Internet server queries **180** the utility company every preset time interval. If new data is present, it transmits **181** this information to the base unit **1** which then updates **182** its watering schedule accordingly.

[0088] As illustrated in FIG. **1**, the Internet server **9** obtains weather information **15** from the national climate data center currently located at www.ncdc.noaa.gov. The server **9** can also obtain weather information from servers for the national digital forecast database XML/SOAP service currently located at www.weather.gov.gov/xml. These servers support requests from other computers and send data about a geographical area in XML format.

[0089] Weather information can also be used to optimize water consumption as shown in FIG. **19**. The Internet server **9** requests from the public weather servers, weather data corresponding to the geographical location of each base unit. The server **9** queries **190** the weather information server every preset time interval. When it receives new information, it computes **191** a sprinkler schedule and sends this schedule to on the base unit. **1**. The base unit, in turn, updates **192** the sprinkler system.

[0090] The government mandated watering schedule is also used by the server **9** to calculate watering schedules (for example weekly/daily). This schedule is then sent to the base unit **1** and used to activate the sprinklers.

[0091] The internet server can also communicate with the water company to retrieve water usage rates, discount or overcharge hours, water quality advisories.

[0092] Floor moisture sensors **6** and **7** that generate information regarding the absence or presence of a flood are also linked to the base unit **1**. In the presence of a flood, an alarm is generated and an Internet message is sent to the user.

[0093] This invention can also be used to monitor water usage at different points around a house or in a residential complex, and allows the identification of problematic and wasteful water consumption behavior and usage.

[0094] Several enhancements can facilitate the incorporation of conventional water meter into this invention. The following techniques may be used.

[0095] Typical water meter usually count the rotations of an impeller immersed in the water to obtain a measure of the flow. The meter senses the fluctuation of the magnetic field produced by the motion of a magnet coupled to the impeller to generate a count proportional to the water usage. This fluctuating magnetic field can be sensed outside the meter by means of a magnetic field sensor based on the Hall effect. As illustrated in FIG. **20** a magnetic sensor external to the water meter can be used to independently obtain **200** a measure of the water usage which may then be transmitted **201** to the base unit.

[0096] Sometimes, the magnetic field is intentionally shielded by the water meter manufacturers to prevent tempering with the meter's operation. In these cases, as shown in FIG. **21** it is possible to use an optical method to read the meter dial and to obtain a measure of water usage. For example a CCD camera can take pictures **210** of the dial and this picture can be processed to extract counter information.

[0097] It is evident to those skilled in the arts that the same technology as this invention can be used to monitor other utilities such as gas and electricity. The peripherals to monitor in these cases include watt-meters and gas meters. If solar energy is produced in the home, solar panels are peripheral that can also be included.

[0098] While the above description contains much specificity, the reader should not construe this as limitations on the scope of the invention, but merely as examples of preferred embodiments thereof. Those skilled in the art will envision many other possible variations within its scope. Accordingly, the reader is requested to determine the scope of the invention by the appended claims and their legal equivalents, and not by the examples which have been given.

I claim:

1. A water consumption monitoring and control system that allows a user to monitor and control water consumption, comprised of a base unit, said base unit comprising

a) a display and a data entry device;

b) a microprocessor functionally connected to said display and said data entry device;

c) a first communication link to at least one water meter, said first communication link functionally connected to said microprocessor, and transmitting water usage from said water meter to said base unit;

d) a second communication link to the Internet, said second communication link functionally connected to said microprocessor, and transmitting said water usage from said base unit to said user over the Internet.

2. The water consumption monitoring and control system of claim **1** wherein said microprocessor converts said water usage to monetary amounts and makes available the display of said monetary amounts to said user over the Internet.

3. The water consumption monitoring and control system of claim **1** also comprising a communication link to at least one pressure sensor, wherein said at least one pressure sensor sends water pressure information to said base unit wherein said microprocessor compares said pressure information with pre-entered criteria and generates an alarm if said pressure information does not conform with said pre-entered criteria.

4. The water consumption monitoring and control system of claim **3** wherein a message over the Internet is generated if said alarm is triggered, said message being in the form of email, tweet, or text.

5. The water consumption monitoring and control system of claim **3** also comprising a communication link to at least one water shut-off valve, wherein said at least one pressure sensor sends water pressure information to said base unit wherein said microprocessor compares said pressure information with pre-entered criteria and generates a shut-off signal if said pressure information does not conform with said pre-entered criteria, said shut off signal being sent to said at least one shut-off valve.

6. The water consumption monitoring and control system of claim **5** wherein said pre-entered criteria includes water leak and pipe breakage profiles and is used to detect said leak or said breakage.

7. The water consumption monitoring and control system of claim **5** wherein said second communication link to the Internet establishes communication between said base unit

and local water utility company, said water usage and said pressure information being sent to said utility company, wherein said utility company evaluates said water usage and said pressure information against pre-set usage and pressure criteria, and sends said shut-off command signals to said base unit if said water usage and pressure information does not conform to said pre-set usage and pressure criteria, said shut off signal being forwarded to said at least one shut-off valve.

8. The water consumption monitoring and control system of claim **3** wherein said second communication link to the Internet establishes communication between said base unit and an Internet server, wherein said second communication link carries said water usage and said pressure information to said server, and wherein said server evaluates said water usage and said pressure, generates usage control information and returns usage control information to said base unit through said second communication link.

9. The water consumption monitoring and control system of claim **1** wherein said second communication link to the Internet establishes communication between said base unit and an Internet server, wherein said second communication link carries water usage information to said server, and wherein said server evaluates said water usage, generates usage control information and returns usage control information to said base unit through said communication link.

10. The water consumption monitoring and control system of claim **1**, wherein said second communication link to the Internet establishes communication between said base unit and an Internet server, and furthermore wherein said Internet server receives water schedule advisories from the local government water department and generates government advisory control information, and sends said government advisory control information to said base unit.

11. The water consumption monitoring and control system of claim **1**, wherein said second communication link to the Internet establishes communication between said base unit and an Internet server, and furthermore wherein said Internet server receives weather information from the weather office and generates weather advisory control information, and sends said weather advisory control information to said base unit.

12. The water consumption monitoring and control system of claim **1**, also comprising a communication link to a sprinkler system, said sprinkler communication link carrying sprinkler control information to said sprinkler system.

13. The water consumption monitoring and control system of claim **1**, also comprising a communication link to at least one water temperature sensor, said temperature communication link carrying temperature information from said temperature sensors to said base unit, said temperature information being used to calculate energy usage in heating up water.

14. The water consumption monitoring and control system of claim **1**, also comprising a communication link to at least one vibration sensor, said vibration sensor configured to detect vibration produced by the operation of a flush toilet tank, said communication link carrying vibration data to said base unit, said vibration data being used to monitor the operation and detect malfunctions of said flush toilet tank.

15. The water consumption monitoring and control system of claim **1**, also comprising a communication link to at least one floor moisture sensor, said moisture sensor link carrying floor moisture data indicative of the presence or absence of a flood, said moisture data being used to generate, if appropriate, an alarm signal and a message over the internet to said user.

16. The water consumption monitoring and control system of claim **1**, comprising at least two water meters, wherein each said at least two water meters are located in different housing units.

17. A method for monitoring and controlling water consumption comprising:

a) monitoring water usage;

b) monitoring water pressure;

c) detecting breakage or leaks in water pipes by comparing, over time, said water pressure and said water usage to predetermined criteria;

d) issuing shut-off command if such said breakage or said leak is detected.

18. The method for monitoring and controlling water consumption of claim **17** also comprising issuing an internet message, said message being in the form of email, tweet or text.

19. The method for monitoring and controlling water consumption of claim **17** also comprising:

a) obtaining weather information from weather office

b) calculating watering schedule using said weather information

20. The method for monitoring and controlling water consumption of claim **17** also comprising:

a) obtaining watering advisories from local government office

b) calculating watering schedule using said watering advisories.

* * * * *

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(12) **United States Patent**
Blackwell et al.

(10) **Patent No.:** **US 9,709,421 B2**
(45) **Date of Patent:** ***Jul. 18, 2017**

(54) **METHOD AND SYSTEM FOR PROVIDING WEB-ENABLED CELLULAR ACCESS TO METER READING DATA**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(65) **Prior Publication Data**

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Related U.S. Application Data

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(51) **Int. Cl.**
G01D 4/00 (2006.01)
H04L 29/08 (2006.01)

(52) **U.S. Cl.**
CPC ***G01D 4/002*** (2013.01); ***H04L 67/025*** (2013.01); ***H04L 67/125*** (2013.01); ***H04L 67/2828*** (2013.01); *Y02B 90/241* (2013.01); *Y02B 90/243* (2013.01); *Y02B 90/246* (2013.01); *Y04S 20/32* (2013.01); *Y04S 20/325* (2013.01); *Y04S 20/42* (2013.01)

(58) **Field of Classification Search**
CPC G01D 4/002; H04L 67/025
USPC 340/870.02, 870.03; 455/414.1
See application file for complete search history.

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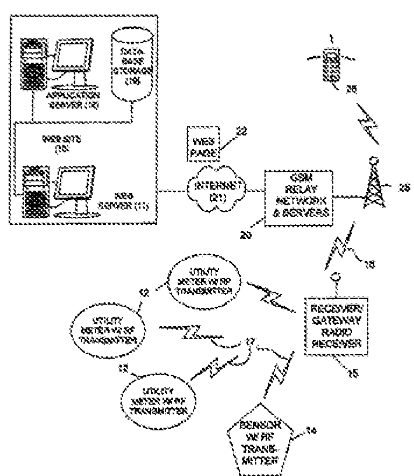
(74) *Attorney, Agent, or Firm* — Boyle Fredrickson, S.C.

(57) **ABSTRACT**

A method and a system for collection of meter readings from meter reading and transmitting devices (**12**, **14**) and for viewing on a web-enabled wireless communication device (**28**) comprises addressing at least one receiver (**15**) through the Internet (**21**) and obtaining a data file of meter data for a plurality of meter reading devices (**12**, **14**) that have previously communicated with the receiver (**15**). The receiver (**15**) can then re-transmit the meter data through a wide area network such as the Internet (**21**) to a web site (**10**) operated by an organization marketing AMR systems. The meter data is then accessed and displayed at a customer demonstration site using a handheld wireless smart phone (**28**) which receives a web page (**22**) that is reduced in size for transmission through the cellular network to the smart phone (**28**).

19 Claims, 2 Drawing Sheets



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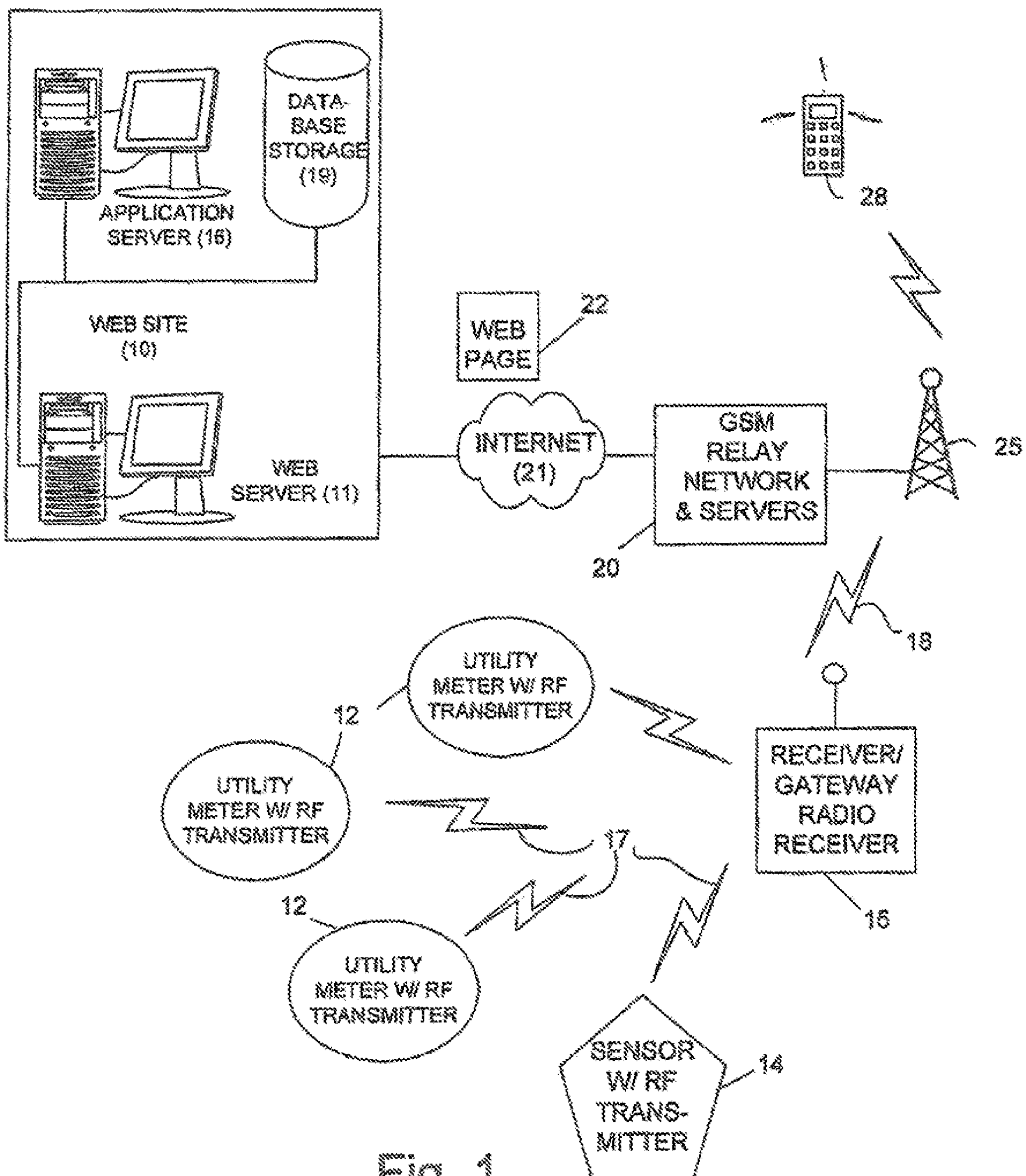
DATA-BASE STORAGE (19)
APPLICATION SERVER (16)
WEB SITE (10)
WEB SERVER (11)
WEB PAGE
22
INTERNET (21)
GSM RELAY NETWORK & SERVERS
20
28
25
18
UTILITY METER W/ RF TRANSMITTER
12
UTILITY METER W/ RF TRANSMITTER
12
UTILITY METER W/ RF TRANSMITTER
17
RECEIVER/ GATEWAY RADIO RECEIVER
15
SENSOR W/ RF TRANS-MITTER
14

Fig. 1

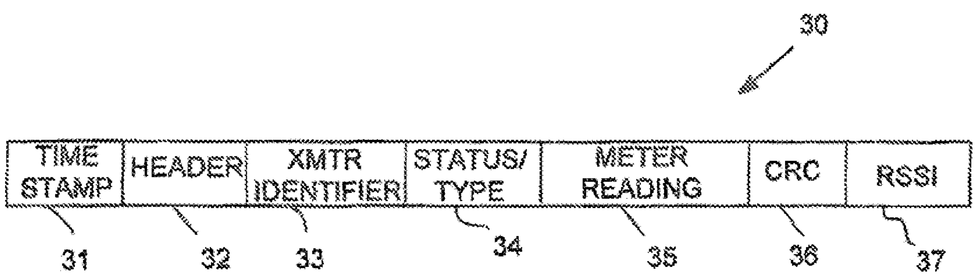
30
TIME STAMP
HEADER
XMTR IDENTIFIER
STATUS/ TYPE
METER READING
CRC
RSSI
31
32
33
34
35
36
37

Fig. 2

METHOD AND SYSTEM FOR PROVIDING WEB-ENABLED CELLULAR ACCESS TO METER READING DATA

This application is a continuation of U.S. application Ser. No. 12/572,432, filed Oct. 2, 2009, the disclosure of which is hereby incorporated by reference herein.

TECHNICAL FIELD

This invention relates to automatic meter reading (AMR) systems using radio transmitters and receivers for collecting meter data signals over a geographical area, such as a municipality or utility district.

DESCRIPTION OF THE BACKGROUND ART

Fixed network (non-mobile) AMR (automatic meter reading) systems typically involve meters equipped with radio transmitters operating in a local area network with radio receivers, often mounted on a rooftop or a utility pole. The receivers also sometimes operate as gateways, for collecting meter data from the transmitters and then transmitting the meter data through a second network to a central office. The meter data is transmitted from the receivers or gateways to the central office for processing into customer statements of account. Typically, there is at least a network communications computer and an applications computer at the central office of the local utility, although various systems at the collection end are possible and are known in the art.

In the prior art, installing an AMR system included the setting up of a central office data collection system and a database for the meter data.

In the marketing of AMR systems, it would be advantageous to demonstrate the collection of meter reading data before actual installation of the central office data collection system. Prospective customers could then see how the system would work prior to contracting for installation of a large system.

SUMMARY OF THE INVENTION

The invention provides a method and a system for collection of meter readings from meter reading and transmitting devices and for viewing meter data on a web-enabled wireless communication device.

The method comprises addressing at least one receiver through a wide area network, preferably the Internet, to obtain meter data from at least one and usually a plurality of meter reading devices that have previously communicated with the receiver. The receiver can then re-transmit the meter data to a web site operated by the organization marketing AMR systems. The data is then be accessed from a customer demonstration site, preferably using a wireless communication device.

The method and system of the present invention can run on a web site that can be reached through a GSM or other cellular network. The method of the invention further includes reading a file of meter data in the form of an HTML web page, which is then modified for viewing on a web-enabled handheld wireless communication device.

The wireless communication device is preferably a web-enabled wireless communication device, such as a Blackberry web-enabled cellular phone, another web-enabled cellular phone or personal digital assistant (PDA). In alternative embodiments, the web-enabled wireless communication device can also be a laptop with wireless Internet capability, but a handheld wireless processor-based device is considered advantageous and is strongly preferred for convenience and portability.

The invention provides a demonstration tool that can be operated at a customer demonstration site by a sales person as part of a customer presentation without requiring assistance from engineering personnel as practiced in the prior art. The use of a Web application on a web-enabled telephone simulates collection of data at a utility collection site. This will demonstrate the capabilities of the AMR-networked system prior to purchase by utility customers and installation at their premises.

Other objects and advantages of the invention, besides those discussed above, will be apparent to those of ordinary skill in the art from the description of the preferred embodiments which follows. In the description, reference is made to the accompanying drawings, which form a part hereof, and which illustrate examples of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic of a fixed-network AMR system for collecting meter data from transmissions from meter data reading devices and making the data available through a web-enabled cellular device; and

FIG. **2** is a data map of data received from the meter reading devices.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1**, a network gateway receiver **15** is installed on a roof top (not shown) or on a utility pole (not shown). In this preferred embodiment, the utility is water, however, in other embodiments the utility can be gas or electricity.

A plurality of meter reading devices **12** each include a utility meter, a transducer and an RF (radio frequency) transmitter. In this example, the units **12** can be meter reading and transmitting units commercially offered under the Orion® trademark or the Galaxy® trademark by the assignee of the present invention. These meter reading devices **12** transmit radio frequency (RF) signals **17** to the receiver **15** to form a local area wireless network. It should be understood that there is typically more than one receiver **15** in a network, although only one is illustrated in FIG. **1**. Sometimes the receiver **15** is also referred to as a "gateway" because it interfaces between the local area wireless network and another longer range network **21**. Alternatively, the meter reading devices **14** may be sensors for sensing other types of conditions at the utility meter or in supply links connected to the utility meters. These sensors may be connected to Orion® or Galaxy® radio transmitters to transmit status data to the receiver **15**.

The meter reading devices **12**, **14** read meter data and certain alarm/condition status data from the meters. As used herein, the term "meter data" should be understood to include either utility consumption data or condition status data, or both. Condition status data includes leak detection data, tamper data and shut-off valve data and other types of data concerning meter operation besides actual utility consumption data.

The devices **12**, **14** transmit data-encoded RF signals over low power RF frequencies either in the non FCC-licensed ISM (Industrial-Scientific-Medical) band from 902 MHz to 928 MHz or in the FCC-licensed frequencies such as 150-200 Mhz, 325 MHz, 433.92 MHz or from 450 to 470 MHz.

The meter data transmitters **12**, **14** transmit to an RF receiver **15**, which in this case is a Galaxy® receiver offered by the assignee of the present invention. The receiver **15** is provided with wireless capability to re-broadcast transmissions to a GSM cellular tower **25**, a GSM network **20** and the Internet **21** to a GSM-networked web site **10**. This web site **10** includes a web server **11** for handling communications in both directions through the Internet **21**, and an applications server **16** for handling the content of pages for communication and display through the Internet **21**. The applications server **16** also stores and accesses data in a database stored in a database storage unit **19**. The database stores a receiver network address, a list of transmitting devices **12**, **14** served by the receiver **15**, a history of readings for the transmitting devices **12**, **14** and a history of readings from the receiver **15**. It should be mentioned here that many architectures are available for web sites using additional servers and these are within the scope of the present invention.

The web site **10** will store the meter data in web pages **22** that can be accessed at an Internet Protocol (IP) addresses having the format XXX.YY.ZZZ, where X, Y and Z are individual numbers from "0" to "9" or preferably at a domain name/URL address of the form http://www.(name).(domain)/where "(name)" is the site identifier and "(domain)" is a domain such as .com or .(country).

These web pages can be accessed through a GSM relay network and servers **20** that can convert HTML pages to web pages of a type that can be displayed on the visual display portion of a wireless handheld device, such as a Blackberry™ smart phone, as disclosed in U.S. Pat. No. 7,302,637, issued Nov. 27, 2007, the disclosure of which is incorporated here by reference.

The web site **10** will have its own distinctive domain name or IP address. It can be maintained by the marketing organization or a hosted by a third party on behalf of the marketing organization.

An application program is provided on the handheld wireless device **28** to access the web site **10** and obtain a reduced size version of the web page **22** through the GSM relay network and servers **20**.

When accessed by a user of the handheld device **28**, a log-in screen will appear prompting the user to enter a user name and a password. After logging in, the user will have an option to select a "Monitor mode or a Data View" mode. A search screen will also be available to allow the user to find the data for a specific transmitter. The web site **10** is addressed and a web page **22** of data is transmitted from the web site **10** to the web-enabled wireless device **28** through the Internet **21** and is converted to a reduced size web page as the web page **22** is transferred through the GSM relay network and servers **20**. On the handheld device **28**, a reduced size "Monitor" web page **22** will display the last transmissions that were received by the receiver/gateway **15** from the meter/transmitters **12**. The data displayed on the "Monitor" web page will include the transmitter number, the time of reception and an indication of signal strength (by a graphic representation of the RSSI). By selecting a line on the screen display of the web-enabled wireless device, the user can cause a display of a history of daily transmissions received from a specific transmitter.

The data is preferably displayed in a WAP format supported by web-enabled smart phone devices such as a Blackberry™ smart phone. Each line of data contains data received from one of the transmitters. FIG. 2 shows a map of each line of data **30** in a web page **22**. There is a first item of data **31** which is a time stamp for the individual meter reading device **12**, **14**. Next, there is a header **32**. This is followed by an item of data **33** representing the identifier, such as a serial number of the transmitter which corresponds to each meter reading device **12**, **14**. Next, there is a status or type item of data **34** which identifies one of several types meter reading devices **12**, such as an RTR® pulse register/transmitter type, an ADE® digital encoder type, or gas meter registers, or other designations for completely electronic registers. This is followed by the actual meter data or status condition data, as represented by item **35**. This is followed by a CRC item of data **36**, which is a cyclic redundancy code or error checking code computed from the data earlier in line of data. Finally, a radio signal strength indicator (RSSI) item of data **37** is provided from each meter reading device **12**, **14** for radio network diagnostics purposes.

As seen from the above description, the invention provides for easier demonstration of the data collection abilities of an AMR system on a handheld wireless processor-based device, thereby saving labor and installation cost and providing ease of use to the marketing organization and the utility customer.

This has been a description of the preferred embodiments, but it will be apparent to those of ordinary skill in the art that variations may be made in the details of these specific embodiments without departing from the scope and spirit of the present invention, and that such variations are intended to be encompassed by the following claims.

We claim:

1. A method for collection of meter data through a wide area network from at least one receiver communicating in a local network with at least one meter reading device in a geographic area, the method comprising:

receiving meter data generated by a utility meter and provided to a meter reading device, the meter data including both utility consumption data readings and condition status data generated by the utility meter, through the wide area network at a web site from a receiver that received the meter data from the meter reading device;

storing the meter data at the web site; and

accessing the meter data at the web site using a wireless communication device and displaying the meter data on a display portion of the wireless communication device, wherein the condition status data includes at least one of leak detection data, tamper data, radio signal strength, and shut-off valve data.

2. The method of claim **1**, wherein the meter data is accessed by an application program on the wireless communication device that displays the meter data as a reduced size web page.

3. The method of claim **2**, wherein the wireless communication is a handheld web-enabled phone device.

4. The method of claim **3**, wherein the handheld web-enabled phone device communicates through a GSM cellular network.

5. The method of claim **2**, wherein the meter data is received at the web site as an HTML web page and is stored at the web site.

6. The method of claim **5**, wherein the wide area network is the Internet.

7. The method of claim **1**, wherein the meter reading devices include devices for reading condition status data related to a meter or to supply links connected to the meter, and wherein the meter data includes condition status data.

8. A system for displaying meter reading data collected from at least one reading device in a geographic area, the system comprising:

a computer server implementing a web site for receiving and storing a data file through a wide area network from the at least one receiver that includes meter reading data, including both utility consumption data readings from the utility meter and condition status data, from a plurality of meter reading devices; and

a web-enabled cellular phone executing an application program for the web-enabled cellular phone for displaying condition status data and utility consumption data readings communicated from the web site accessible through a cellular network, wherein the condition status data includes at least one of leak detection data, tamper data, radio signal strength, and shut-off valve data.

9. The system of claim **8**, wherein the application program displays the meter data as a reduced size web page on a display portion of the web-enabled cellular phone.

10. The system of claim **8**, wherein web-enabled cellular phone communicates through a GSM cellular network.

11. The system of claim **8**, wherein the meter data is received at the web site as an HTML web page and is stored at the web site.

12. The system of claim **11**, wherein the wide area network is the Internet.

13. The system of claim **8**, wherein the meter reading devices include devices for reading condition status data related to a meter or to supply links connected to the meter, and wherein the meter data includes condition status data.

14. A method for collection of meter data through a wide area network from at least one receiver communicating in a local network with at least one meter reading device in a geographic area, the method comprising:

receiving data through the wide area network at a web site from the at least one receiver that includes meter data generated by a utility meter and provided via a meter reading device to the at least one receiver, the meter data including both utility consumption data readings and condition status data generated by the utility meter;

receiving a request to display the meter data at the web site from a wireless communication device; and

transmitting the meter data for display on a display portion of the wireless communication device, wherein the utility consumption data readings are meter readings for at least one meter reading device that have been transmitted at a defined time interval,

wherein receiving a request to display the meter data at the web site from a wireless communication device includes selection of a link displayed on a web page specific to the at least one meter reading device.

15. The method of claim **14**, wherein the meter data is displayed on the display portion as a reduced size web page.

16. A method for collection of meter data through a wide area network from at least one receiver communicating in a local network with at least one meter reading device in a geographic area, the method comprising:

receiving data through the wide area network at a web site from the receiver that includes meter data from at least one meter reading device;

receiving a request to display the meter data at the web site from a wireless communication device; and

transmitting the meter data for display on a display portion of the wireless communication device, wherein the meter data includes a plurality of meter readings for at least one meter reading device that have been transmitted at a defined time interval, wherein the meter data includes an indication of signal strength.

17. The method of claim **16**, wherein the indication of signal strength includes an indication of signal strength for each defined time interval.

18. The method of claim **17**, wherein the defined time interval is daily.

19. A method for collection of meter data through a wide area network from at least one receiver communicating in a local network with at least one meter reading device in a geographic area, the method comprising:

receiving data through the wide area network at a web site from the receiver that includes meter data generated by a utility meter and provided via a meter reading device to the at least one receiver, the meter data including both utility consumption data readings and condition status data generated by the utility meter;

receiving a request to display the meter data at the web site from a wireless communication device; and

transmitting the meter data for display on a display portion of the wireless communication device, wherein the utility consumption data readings are meter readings for at least one meter reading device that have been transmitted at a defined time interval,

wherein the at least one meter reading device includes a least one device for reading condition status data related to a meter or to supply links connected to the meter, and wherein the meter data includes condition status data.

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